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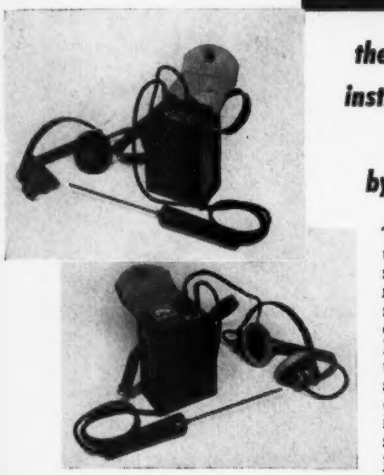

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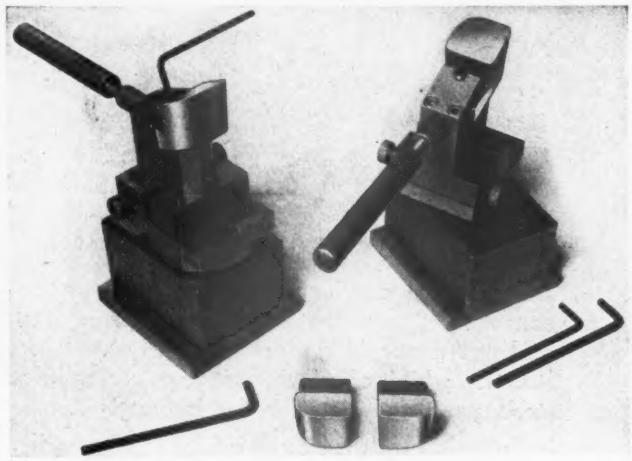

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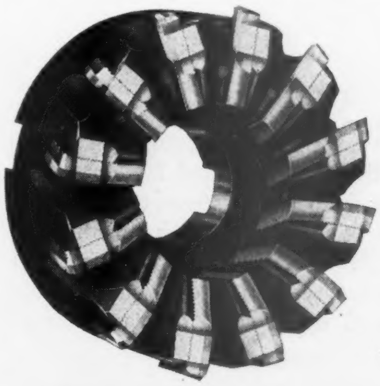

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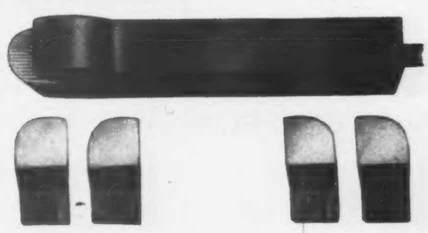

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THE EDITOR'S DESK

Two Essential Functions

Just over two months ago as we go to press the annual meeting of the Mechanical Division was held at Atlantic City with an extensive and instructive exhibit of railway motive power, rolling stock, parts and materials for locomotives and cars, and tools and facilities for use in and about locomotive and car shops. In about two weeks the Coordinated Mechanical Associations, excepting the Electrical Section, will go into session at Chicago. The question has been raised as to what effect the Atlantic City convention and exhibit, with its large enrollment of supervisors who do not regularly attend Mechanical Division meetings, will have on the attendance at the September meetings at Chicago, at which there will be no exhibit.

The answer to that question will have to await the event, but there is good reason why the attendance at these meetings should be good this year, and every year. The reason lies in the completely different functions of the Mechanical Division and the coordinated associations.

The Mechanical Division is largely occupied with problems of design and materials which enter into the construction and successful operation of locomotives and cars and facilitate their maintenance. In the performance of this function it engages in engineering research on an ever-widening scale. It legislates the development and modifications of design standards and of the rules under which freight cars of many ownerships roam the continent and are kept in repair wherever they may be.

The problems arising in the servicing and repair of motive power and rolling stock receive little attention from the Mechanical Division. These are the problems of shop engineering and plant management, of shop methods and of personnel relations, all of which determine whether a dollar of value is received in restored serviceability for every dollar spent for maintenance of equipment. They also include the problems of locomotive operation and train handling, which are not growing simpler.

These things are the functions of the Coordinated Mechanical Associations. That they do not lend themselves to the establishment of uniform standards of procedure in no way detracts from the importance of having them studied and discussed.

An organization or an individual that does not change is dead. The coordinated associations disseminate throughout the industry new ideas and improved practices, which originate in one mind or on one road, thereby hastening their wide application and keeping the industry as a whole alive and in vigorous health.

The railroads can no more afford to neglect the functions of the Coordinated Mechanical Associations than they can the functions of the Mechanical Division.

C. B. Peck

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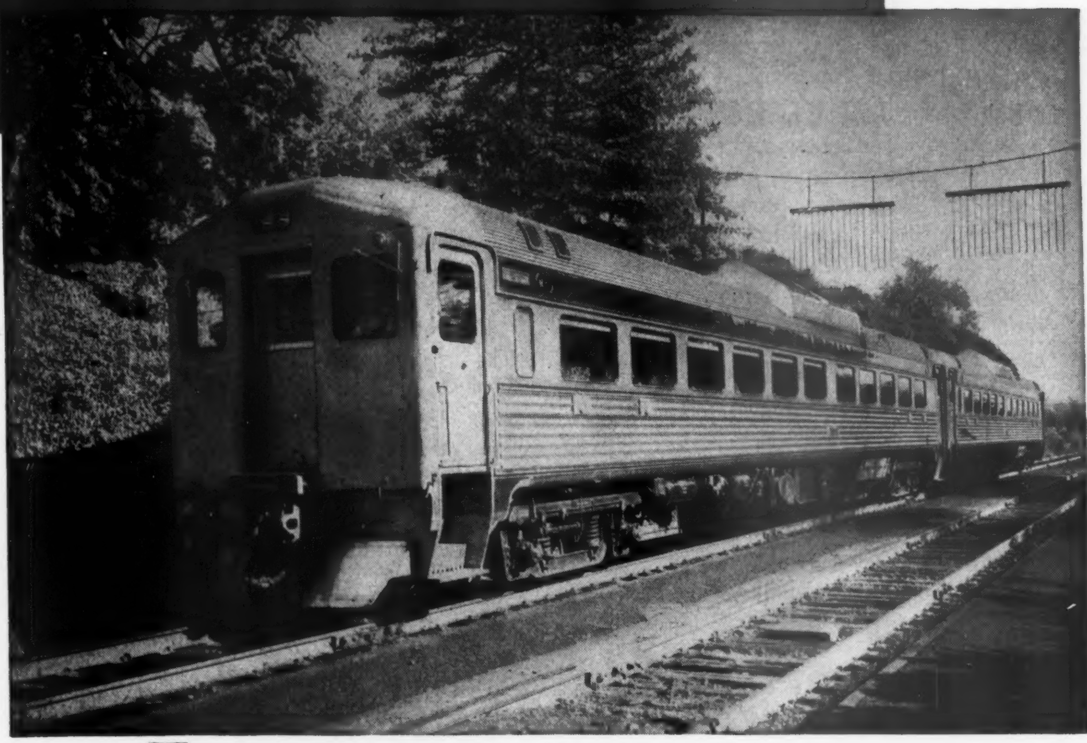

NEW YORK, SUSQUEHANNA AND WESTERN is one of the first Class 1 railroads in the East to be completely Dieselized — and one of the *first* to adopt Railway Diesel Cars to build local passenger traffic. In Susquehanna's popular Speedliner service between New York City and Paterson, N.J., for example, these Budd-built RDC's are surpassing expectations.

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EDITORIALS

And Then We're Through

There are those who hold a dim view of the future of the diesel-electric locomotive. Although they realize it has revolutionized railroad practice and kept the railroads from going into a decline, they feel that the market for diesel locomotives is approaching saturation and that it would be foolish to try to get into it at this time.

Let's look at a few facts and figures. There are now about 22,000 diesel-electric locomotive units in service in the United States. During the past six years the railroads have ordered diesel units as follows: 1947, 2,149 units; 1948, 2,661; 1949, 1,782; 1950, 4,473; 1951, 4,038; 1952, 1,817.

Presently available data and some guesswork indicate that from, say, 29,000 to 35,000 diesel locomotive units could fulfill the motive power needs of all U.S. railroads. Then if the railroads go on buying, say, not more than 2,000 units a year, they will be completely dieselized by 1960.

Then what? Will the market be saturated? To reply to that question, we must first be able to say how long a diesel will last. There are a few switchers in service which are more than 25 years old. But switching service is relatively a light service. There is a constant demand for bigger and better road power. Technical advances are more rapid than they were in the heyday of steam power. The automotive industry has a reputation for making improvements that render old types obsolete, and maintenance costs increase with each year as the locomotive grows older.

For example, let us assume that the average life of a diesel-electric locomotive will be 20 years. Then if there are as many as 35,000 units, it will be necessary to replace 1,750 per year. And that is just about what the market is right now. The difference is that that market is evidently self-perpetuating. Then just to keep the diesel on its toes, there is the gas turbine. And if neither can meet the demand, straight electrification is always available to handle the really big jobs. Those who say, as soon as the market is saturated, we're through, just haven't given the subject sufficient consideration.

A Neglected Way To Reduce Damage

One of the problems, the importance of which may not be fully realized, that faces the car department officer in his everyday work in general and in keeping lading damage payments to a minimum in particular is the present procedure of judging the suitability of a car for loading. To the average shipper or agent not familiar with the mechanical technicalities of a freight car, a car is good if the body is good.

A carman, of course, knows better because he has the necessary knowledge to inspect those parts of the running gear that determine whether the car will ride and stand switching impacts well enough to avoid damage to the lading intended to be hauled in the car.

These points, as well as something that can be done about them, were brought out in a recent talk before the Chicago Car Foremen's Association by A. R. Schroeder, assistant superintendent of loss and damage prevention, NYC. Among the contentions made by Mr. Schroeder was that it is good economic policy to downgrade a car if a combination of defects exists even though no one defect is serious enough to permit renewing the parts or condemning the car. He pointed out that a car with a combination of compressed springs, frozen snubbers and brake-burned wheels can really ruin a load of tile or sewer pipe; similarly, a car with draft gears in poor shape can seriously damage many types of lading in an ordinary switching impact.

The fact that the preceding types of conditions can exist without normally being detected by shippers or agents is no doubt a sizable factor in the $51 million annual bill for unlocated damage to lading. The portion thereof that should properly belong in the category of lading damage caused by defective equipment would probably multiply by several times the six million dollars charged to this account last year. Carrying out the suggestion of grading and downgrading cars to assure damage-free transit of lading would appear to be a valuable contribution that the car department can make to the financial welfare of the railroad by helping to keep business and by reducing the cash outgo for damage.

Will Lower Quality Mean Lower Fuel Prices?

While there may be a question as to whether it is cheaper to purchase high-grade or low-grade diesel fuel we know that the gallon price of fuel gets lower as the quality declines. We might logically assume that we could hit a bonanza of savings from reduced fuel costs if we could learn to burn cheaper grades.

This conclusion seems at first throught to be inescapable, even axiomatic. Yet—silly as it may sound—an entirely different, though not completely incompatible conclusion may be nearer to the right answer for the future. To see why this can be true, consider a few questions pertaining to the general setup for the preparation of diesel fuel oil and to the factors which determine the price.

The oil companies have invested in fixed plant to produce fuel oil with approximately a 50-Cetane rating. Now, if a few users of diesel fuel were to use lower-grade fuel, there would be little if any effect on the price differential that currently exists between high and low grade of fuel. But, suppose that all users of high-Cetane oil were to shift to lower ratings. Is it likely that the price would stay appreciably lower than 50-Cetane fuel?

Would not present 50-Cetane facilities have to be used to produce the lower grade fuel, and hence would it not be burdened with the same capital investment charges as the higher grade fuel bears today? Would it be a question of utilizing the present facilities less efficiently, or would it be possible for a plant to produce a larger quantity of, say 25-Cetane fuel, than it can now produce of 50-Cetane? Would the answer to the preceding question be as important a factor in the future price relationship between the different grades of fuel as it might first seem to be? Remembering that the price of gasoline is the principal factor determining the general price level of the entire distillate range, would any shuffling around of the portions of the crude going into the several types of distillate fuels have a material effect on what the oil companies would have to get for their total distillate output?

And what about the ultimate in cheap fuel—the burning of residual in the diesel? If this could be made practicable in the near future, fuel costs should be materially reduced. But, if any such development is long delayed, will residual remain appreciably cheaper than diesel fuel? Will the oil industry continue to sell residual at a few cents a gallon, or will they perhaps find an end product into which it can be made profitably? That would force the user of residual to pay a price for it that was high enough to compete with its value as a base for any such end product.

We wonder if the chief hope for the railroads to reduce diesel fuel costs through the use of lower grade fuels does not lie in quickly finding a means of making their use practicable—before expensive new facilities are installed to upgrade the poorer fuels or to produce other end products.

NEW BOOKS

THE INERT-GAS-SHIELDED METAL-ARC WELDING PROCESS. *By W. H. Wooding, Superintendent, Metals Section, Philadelphia Naval Shipyard. Published by American Welding Society, 33 West 39th St., New York 18. 30 pages, 8¼ in. by 11¼ in. Paper bound. Price $1.*

The pamphlet covers the Educational Lectures on the fundamentals of the inert-gas shielded metal arc welding process which were presented at the annual meeting of the American Welding Society. There is a brief introduction to arc welding and the developments since World War I concerning the protection of the arc and molten metal from atmospheric contamination. Particular emphasis is given to welding in inert-gas atmospheres leading to the development of the inert-gas-shielded metal-arc welding process. With the aid of sketches and photographs, the author portrays the development of the process, the equipment required, the necessary controls and their function. Special sections are devoted to the operation of the equipment from the operator's viewpoint as well as that of the supervisor and the engineer. The safety precautions necessary for protection of the operator are also included. The characteristics of the inert-gas-shielded metal-arc and the mode of metal transfer are illustrated and explained and the effects of variables on the operation of the equipment in all positions of welding are clearly demonstrated. These variables cover both helium and argon and include gas purity, gas flow, size and condition of electrode wire, current, arc voltage and length, speed of welding and the like. There is a section devoted to the application of the process in fabricating complex structures.

INDUSTRIAL BRAZING. *By H. R. Brooker and E. V. Beatson, B.Sc. (Eng.), A.M.I.E.E. Published for "Welding and Metal Fabrication" by Iliffe & Sons., Ltd., Dorset House, Stamford Street, London, S.E., England, 344 pages, 203 diagrams and photographs and 32 tables. Price $4.90 (Postage 15 cents).*

This book is an authoritative study of brazing as a process for metal fabrication which covers in detail modern brazing methods such as torch, furnace, h.f. induction, resistance, salt bath and dip, while the special considerations necessary in work on aluminum, stainless steels, beryllium copper, cemented carbides and vacuum tube construction are dealt with separately. In addition, a general introduction to the processes and the equipment employed is followed by a review of brazing materials and the most complete summation of the known factors governing joint design. Finally, a chapter discusses problems of selecting the most appropriate brazing process for various types of work and makes a useful contribution on methods of inspection and testing.

Some important *economic facts* about

LOW-COST SOLID BEARINGS

Here are some conservative estimates on the cost per car per year to maintain solid bearings . . . and some basic reasons why no return on an investment in non-standard bearings could be realized:

One The average annual net cost per car for all materials necessary to the maintenance of solid bearings, including oil and packing, amounts to only 2.62% of the current cost of installing expensive non-standard bearings.

Two Based on the number of packers and oilers required by one railroad whose miles-per-hot-box average for 1952 was 3 times the average for all Class I roads reporting to the AAR, the cost per car per year for this labor is only about 3% of the current cost of installing non-standard bearings.

Three All routine solid bearing maintenance costs come to less than the annual fixed charges (interest and depreciation) on the investment necessary to install non-standard bearings. Thus, when you take the high maintenance costs for non-standard bearings into consideration, it can be seen that solid-type bearings are by far the better buy.

• • • • • • • • • • • • • • •

In any serious consideration of bearing economics, it must be remembered that the favorable returns claimed for high-cost non-standard bearings are neither realistic nor practically attainable in the foreseeable future. That's because:

1. Over 50% of the claimed savings are derived by including as costs for solid bearing operation the presumed loss of imaginary revenues that are in reality not available to the railroads.

2. The high cost of periodic disassembly, inspection and reassembly of non-standard bearings (in all probability far higher than comparable costs for solid-type bearings because more time, more skilled labor and more extensive shop facilities would be required) is completely ignored by their promoters.

3. The miles per failure for non-standard bearings is set at a figure several times the actual performance of such bearings in passenger service — where the bearings receive perferred (and costly) maintenance and where they carry far lighter unit loads in far less rigorous service.

4. The claimed savings for non-standard units are also essentially a *prospectus* — because their cost has been estimated at less than one fourth the current cost for comparable bearings on passenger equipment.

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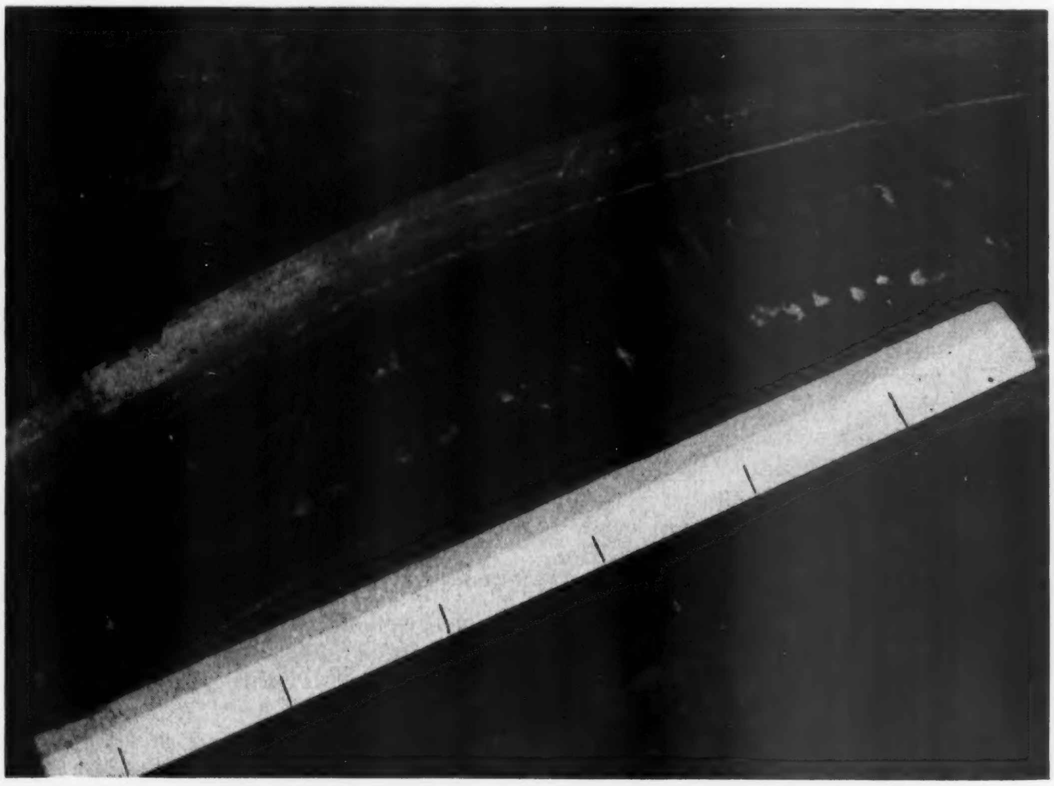


Fig. 1—Typical oxygen cell or crevice corrosion occuring in the head seating area of a diesel engine.

What Corrosion Inhibitors Should and Should Not Do

Treatment of diesel-engine cooling water poses many problems for the railroads. This article outlines some of the solutions.

BY J. F. WILKES

ONE of the problems which was accentuated by dieselization, was employee dermatitis resulting from continual contact with materials handled regularly in diesel service. Typical materials having potential skin irritating properties included diesel fuel oil, detergent lubricants, solvents used in diesel maintenance, lacquer thinners, detergents, various alkaline cleaning compounds, and numerous other substances. When it was learned that chromate cooling system corrosion inhibitors were among the materials which could contribute to skin irritation, railway managements asked for substitute materials, which woud provide necessary protection for cooling systems and be substantially free of skin irritating characteristics.

Presented at the Fourth Railroad Corrosion Conference of the International Nickel Company held at Wrightsville Beach, N.C., May 19-21, 1953. Mr. Wilkes is director, research and product development, Dearborn Chemical Company.

Another factor which accelerated development of substitute inhibitors was the severe chromate shortage which occurred in 1947, following a strike in the soda ash industry. At this time, railroads and Government agencies raised the question as to continued availability of chromate inhibitors, in the event of a serious national emergency which could shut down the alkali industries of the United States, or interfere with ocean transportation of chromite ores. Accordingly, in 1947, laboratory development of substitute inhibitors was started.

In the opening phase of this investigation, the several requirements of diesel cooling system corrosion inhibitors were considered. These requirements, which apply both to chomate inhibitors and to substitute materials, are summarized in the following paragraphs, not necessarily in order of importance. Also, it should not be assumed that all of these requirements were being satisfactorily met by chromate inhibitors:

1. The inhibitor must effectively prevent corrosion of all metals in the circulating system, at normal operating temperatures, whether the metals are coupled or insulated, and under various mechanical conditions which accelerate corrosion. Some of these are presence of vibratory stresses, unequal expansion or contraction, hot spots or excessively high flow rates in the cooling system, together with turbulence and aeration. In addition, the inhibitor must protect the metallic surfaces under adverse conditions, such as non-homogeneity, presence of oxide layers, patchy scales, or occasional oil contamination.

2. The inhibitor must provide specific protection for sensitive nonferrous metals, and critical areas in the cooling systems, such as solder joints in oil cooler radiators. This protection is made most difficult by the numerous dissimilar metals present in some circulating systems.

3. The inhibitor must not damage non-metallic parts of the system, such as hoses, seals, gaskets and seal rings.

4. The inhibitor should have properties of effectively wetting surfaces, and of emulsifying or displacing oil films on heat transfer surfaces. In addition, it must be able to penetrate capillary spaces and crevices, to provide protection against crevice corrosion or differential aeration cells.

5. It should not contribute to foaming, or to stabilization of foam. If such foaming tendencies exist, specific foam control reagents should be incorporated.

6. The treatment must be readily soluble at cooling system operating temperatures, and preferably should be soluble to at least 5 percent strength at room temperatures, to permit automatic treatment plan application.

7. If not fully soluble, the material should be dispersible in the form of a fluid slurry or emulsifiable, and should remain sufficiently stable in dispersion or emulsion to permit automatic application.

8. If water leakage into cooling system occurs, the inhibitor should not damage lubricating oil, cause accelerated oxidation, emulsification or loss of additives at reasonable concentrations—perhaps up to 500 ppm.

9. The inhibitor should contain some tracer element, not common to lubricating oils or additives, and which can be readily identified either by analysis or spectograph to indicate cooling water leakage in lube oils. It is desirable that the inhibitor add a definite color to cooling water, to help locate external leaks, or indicate presence of treatment.

10. The inhibitor must not contribute to scale deposition or form excessively thick films which could interfere with heat transfer.

11. It should not preferentially screen certain areas, or provide patchy protection.

12. It should remain stable and effective in the cooling systems for extended periods. It should not break-down, decompose, volatilize, boil off or be lost by absorption on sludge.

13. It should be capable of effective protection and satisfactory use in waters of moderate hardness, perhaps up to 100-150 ppm total hardness.

14. It should have reasonable tolerance for chloride content or other corrosion accelerating ions in cooling water. For example, it should be able to protect in waters containing up to 170 ppm sodium chloride.

15. The inhibitor should buffer pH within the preferred range of 8.0 to 9.5 (not above pH 9.5), and should remain within this range, so long as the applied dosages do not vary from recommendations by more than plus or minus 25 percent.

16. The cooling system treatment should not cause damage at large over-dosages. Sometimes the applied dosages may reach ten times the recommended concentration. Likewise, under-dosages should not drastically accelerate pitting attack.

17. Toxicity considerations are important. The material should not be hazardous to handle either in concentrated or dilute form, from the viewpoint of allergy, dermatitis, or toxicity, when measured by reasonable standards.

This point deserves special consideration. No chemical, organic or inorganic, is entirely free from certain toxicity or skin irritating properties. The incidence of skin irritation among workers may be expected to average one to two cases per 1,000, for practically all inorganic chemicals encountered. The industrial dermatitis figures are much higher for organic reagents, petroleum products, etc. Also, it must be realized that infectious bacteria, fungi or parasites can enter skin breaks. Workers should avoid the use of harsh, abrasive cleaners or solvents to remove oil and grease from hands. These cause excessive dryness and remove natural skin oils, causing cracking of skin. Dry, cracked skin promotes skin irritation, infection and other dermatitis problems.

18. Warning labels or precautionary markings on containers of cooling system inhibitors should be brief, accurate, and easily understood. Unwarranted use of warning labels on harmless products develops disregard for labels, and is just as undesirable as failure to give adequate notice of hazards.

19. The inhibitor should be suitable for test control both by simple field methods, and by accurate laboratory analysis. Simple test procedures based on a specific ingredient, are preferable to test control by conductivity methods, although these are used effectively in many locations.

20. The product should be suitable for prolonged storage and should not develop caking tendencies, decompose, ferment or deliquesce.

21. If the material is in solid form (pelletized), it should dissolve readily at cooling system temperatures to prevent clogging of circulating pump impellers or other system components. Likewise, the size and shape

must be considered, so that the material can be applied to cooling systems easily. Some diesel locomotives have obstructions in filler pipes, which make it difficult to apply the solid forms of treatment.

22. Industrial waste disposal considerations may be significant in some areas. The inhibitor should not pose an industrial waste problem, but if so classed it should be capable of economical removal or neutralization.

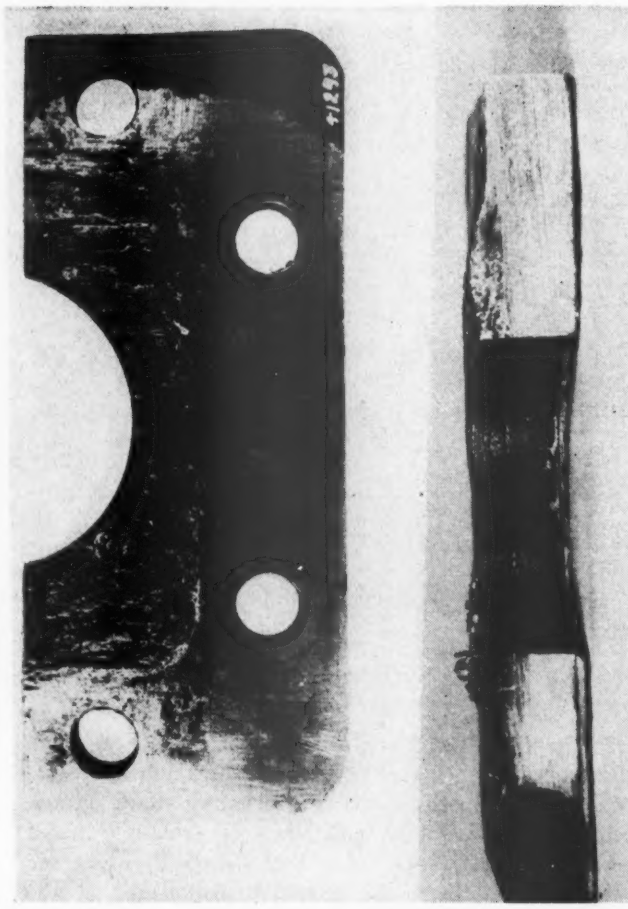
23. The inhibitor should be economically equivalent, at recommended dosages with other established inhibitors, such as chromates.

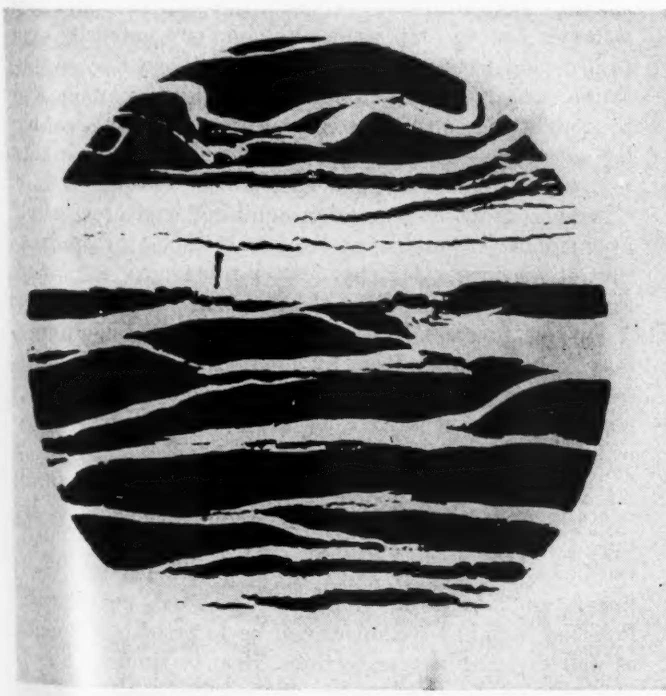
24. If a dye is incorporated in the cooling system treatment, it should not interfere with control tests.

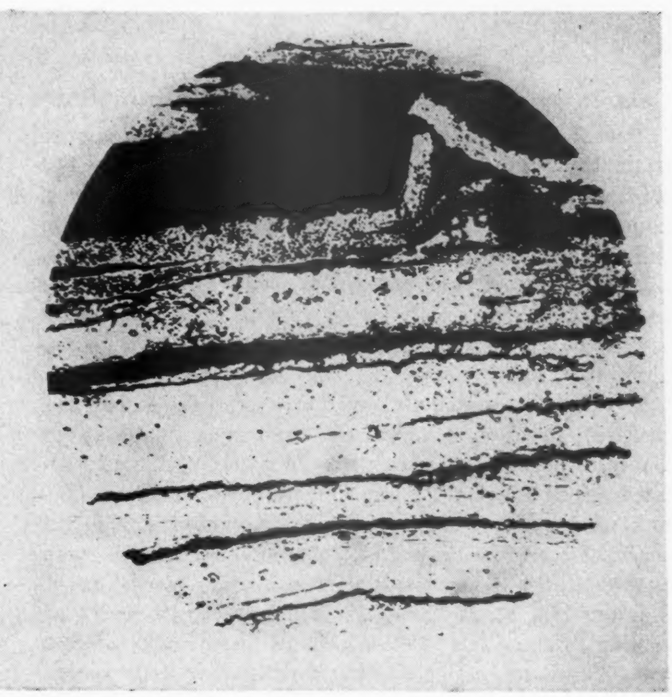
25. It is desirable that the cooling system inhibitor be compatible with anti-freeze solutions. Diesel builders do not recommend use of anti-freeze solutions in diesel cooling systems. However, certain low temperature operations, particularly military applications, may so require under certain conditions.

Corrosion Problems

To illustrate special problems encountered in cooling system corrosion, several photographs are shown. Figure 1 shows a typical oxygen cell or crevice corrosion attack occurring in the head seating area of a diesel engine. Accelerated corrosion of an aluminum radiator header plate is shown in Figures 2, 3 and 4. This was an exfoliation or delamination resulting from intergranular, electrolytic action. Aluminum corrosion frequently occurs by electrolytic attack, when in contact with dissimilar metals such as copper, brass and iron. A bronze cooling system pump impeller damaged by cavitation attack is shown in Figures 5 and 6. The final picture, Figure 7, shows a diesel radiator clogged by metallic oxides, sludge and lint, so that no cooling is provided.





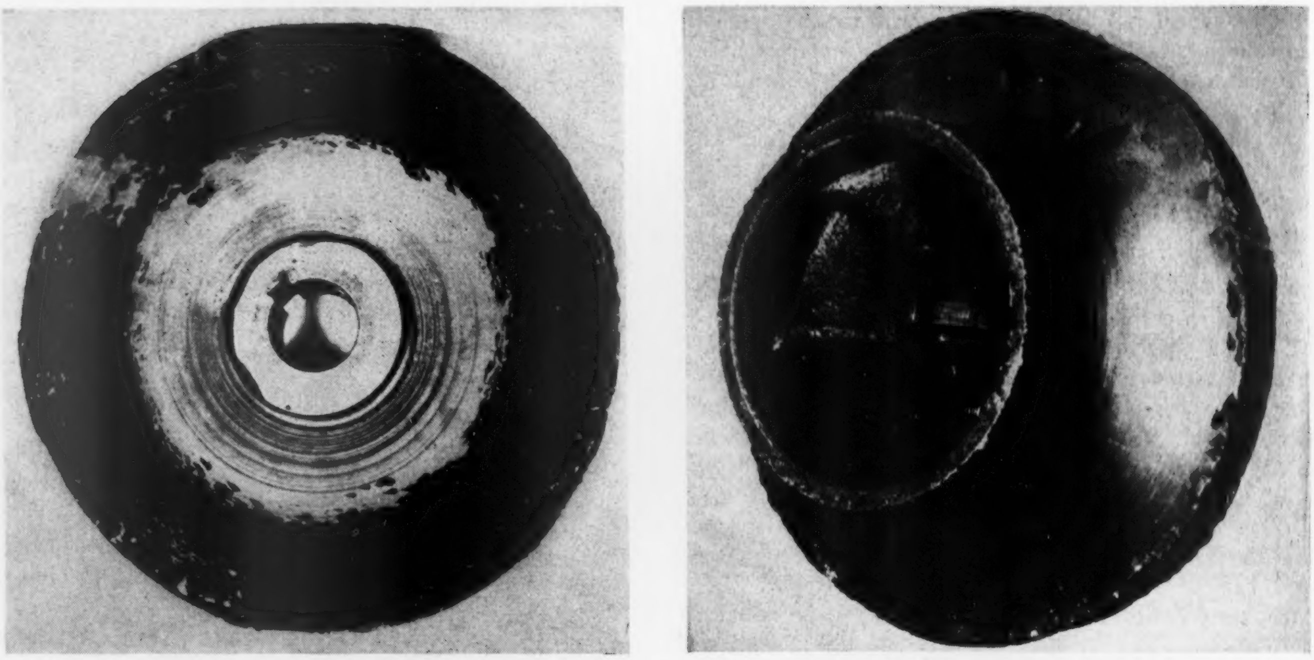


Figs. 2 (right) and 3 and 4 (below)—Accelerated corrosion of aluminum radiator heater plate.

Substitutes for Chromate Inhibitors

Laboratory studies begun in 1947 have produced cooling water treatments containing no chromates but capable of providing maximum protection to cooling system metals. Such a product, for example, is Dearborn Formula 527 and its earlier modifications.

Not only does this formula provide full protection to ferrous metals, and prevent crevice attack, but it also



Figs. 5 and 6—Bronze cooling water pump impeller damaged by cavitation attack.

guards against attack on non-ferrous metals as well. Laboratory and field tests show that Formula 527 actually is superior to chromates in preventing attack on aluminum, both separately, and when electrically coupled to other metals. It does, however, have the disadvantage of reduced solubility (2½ percent to 3 percent) at low temperatures, which interferes with automatic treating plant applications. However, it dissolves readily in engine cooling system at higher temperatures.

Laboratory Investigations of Substitute Inhibitors

Several methods have been used in the laboratory to evaluate various inhibitors. The simplest form of test was a total immersion test of various metal specimens, conducted either at room temperature or heated, both quiescent and agitated. The test containers were both open and closed, but were not specifically aerated. In tests of these type, couples of various metals normally are included. Metals tested included steel, cast iron, aluminum, brass, bronze and radiator tubing.

A rotating spindle, dynamic testing method also was devised. In this method, five specimen plates were clamped between rubber discs and the specimens rotated at 550 to 600 r.p.m. in the test solution. This test procedure would develop a maximum peripheral speed of approximately 7 ft. per second. Specimens were exposed for five successive cycles, a cycle consisting of 5 hours run at 180 deg. F, followed by 19 hours of cooling to room temperature. Metals tested included cast iron, aluminum, copper, brass, and tin. Generally speaking, results were not reproducible since the aluminum often would not corrode, in contrast with field experience, and there was considerable crevice action at the clamped edges.

The next test method developed was a screening test, patterned after a test used by General Motors, Electro-Motive Division Laboratories. This test may be described as a circular path, slow flow test. It covers an operating period of 96 hours, all test solutions being aerated by oil-free compressed air at a controlled rate. Temperature is maintained at 185 deg. F, plus or minus 5 deg., by use of oil baths. Polished specimens of controlled size are suspended on horizontal glass hooks. Metals used are cast iron, mild steel, 70-30 brass, brass covered with standard solders (or radiator tubing), aluminum and bronze. Ordinarily this test is run with specimens uncoupled, separated about ¼ inch by glass spacers. Test solutions are made up either in distilled water or Chicago tap water. Volumes are carefully controlled, and tests are rejected if the daily loss by evaporation exceeds 25 mls. Evaluations are made visually and by weight loss measurements, after chemically cleaning the specimens. Test results by this procedure are highly reproducible and have provided an effective method of screening proposed corrosion inhibitor mixtures. (Full instructions for conducting the test, methods for preparation of specimens, for chemical cleaning after tests, and metallurgical composition of specimens, are available.)

Further to extend the screening test, the conditions may be made more severe by coupling various dissimilar metals. This may be accomplished by clamping the specimens together, separated by brass ferrules or spacers which provide electrical contact.

To provide a dynamic test which is typical of diesel operations, a constant flow device has been devised. In this system, treated cooling water is circulated past specimens at pumping rates up to 30 gal. per min. and linear velocities in the range of 5 to 20 ft. per second. Polished, weighed specimens can be inserted in the unit, as well as weighed pipe sections. Heat to simulate diesel operation is provided either by immersion heaters or heat exchangers, as desired. The combination of coupled metal specimens and high flow rates duplicates to a reasonable extent the difficult conditions encountered in diesel operations, and permits final evaluation of diesel cooling system inhibitors before actual field testing.

Evaluating Inhibitor Performance

The method of rating or evaluating the performance of inhibitors as determined by specimen weight losses

TYPICAL WEIGHT LOSS DATA—(96 hours test, uncoupled, hot, aerated) WEIGHT LOSSES—MILLIGRAMS/SQ. DECIMETER/DAY (MDD)

Test Formula	Aluminum	Brass	Bronze	Cast Iron	Solder (or Radiator Tube)
Formula 517 (Chromate) at 0.5 oz./gal.	2.0–10.0	1.2	1.0	0.5	1.5–3.0
Formula 527 (Non-Chromate) at ¾ oz./gal.	0.5– 1.0	1.0–1.5	2.0	0.0–2.0	0.2–0.7

in milligrams per square decimeter per day (MDD), must be given close attention. The following rating system has been suggested:

0 to 1 MDD—no corrosion
1 to 10 MDD—very slight corrosion
10 to 100 MDD—intermediate corrosion, possibly dangerous
Over 100 MDD—serious corrosion, to failure

While this corrosion rating system may be satisfactory under average industrial conditions, it is not fully applicable to conditions existing within a diesel cooling system. Therefore, it is essential to rate test specimens *visually*, based on the appearance and type of attack, as well as on weight loss measurements. Test personnel should look for evidence of crevice corrosion and localized pitting, localized attack resulting from vibratory effects, and for indications of darkening, or formation of a visible film. The weight loss rating also must be sharply modified for thin sections, such as radiator tube. In such sections a low weight loss may be significant, particularly if there are indications of pitting, attack on solder joints, etc.

The table compares laboratory results obtained using chromate Formula 517 with Formula 527.

In evaluation of substitute corrosion inhibitors, hundreds of materials and combinations have been tested. These evaluations have included a large group of inorganic salts, organic compounds, and metallo-organic salts, as well as organic and inorganic mixtures. Of the materials so far evaluated in laboratory and field tests, Formula 527 gives the best results. However, the laboratory work is continuing in order to produce a material of even higher efficiency and increased solubility, to facilitate automatic application in the field.

Special Considerations

During laboratory development, many special laboratory evaluations were made in order to answer specific questions frequently raised in the field. Some of the information so obtained is summarized below.

1. *Effect of Hard Water.* When used with hard water, Formula 527 may cause a small amount of insoluble precipitation. Good protection still is provided on long term tests. However, new non-ferrous specimens, added to old hard-water solutions may show slight increase in corrosion rate, indicating minor loss of essential inhibitor materials due to precipitation.

2. *Effect of Chlorides.* Action of chlorides up to 10 grains per gallon has been evaluated in tests of 150 hours duration, against aluminum, iron, radiator tubing and other metals. A slight dulling of aluminum occurs at 10 grains per gallon chloride, but all weight changes are less than one milligram per square decimeter per day. Slight dulling of the radiator tubing was noticed on the tin side. No indications of accelerated corrosion are seen.

3. *The Action of tannins, modified lignins and similar organics.* The inclusion of these organic reagents tends to increase all corrosion rates slightly. They may also stabilize foaming tendencies.

4. *Effect of long Exposure on the stability of the corrosion inhibitors.* Extended tests of 60 days duration showed virtually no pH change, or loss of inhibitors. These tests were run both hot and cold, aerated and unaerated. A slightly greater metal loss may be expected in aerated tests, particularly on radiator tubes.

5. *Effect of changing inhibitors from chromate to chromate substitutes.* Tests made in which specimens were first exposed to chromate Formula 517 for extended periods, then changed to Formula 527 for an additional test period showed no action on the metals, and indicated that continuous protection was provided.

6. *Effect of Mixtures of Inhibitors.* When specimens were exposed to mixtures of 527 and 517, or mixtures of Formula 527 with competitive materials, results were generally satisfactory, but depended entirely upon concentration. At recommended dosages, the protection obtained from mixtures is a function of the relative concentration. Either Formula 527 or 517 alone, might be expected to give better protection than mixtures of the two. The same would apply to the results to be obtained with mixtures of Formula 527 and competitive formulations.

7. *Effect of Soluble Oils.* In laboratory screening tests these materials have consistently failed to give satisfactory protection, and have allowed accelerated metal losses far in excess of those obtained using either Formula 517 (chromate) or Formula 527.

Field Investigations

Before starting a field test of a chromate substitute and when making field inspections, the following items should be given consideration:

Examine liners carefully, particularly those with removable jackets. Look around the vanes, at water inlet points, and in areas of stress concentration, for accelerated corrosion. Look at areas beneath seal rings, and in other capillary areas to observe indications of crevice corrosion or oxygen cell attack.

Specifically locate and mark all pitted areas, roughened areas, stained or discolored spots which may indicate incipient corrosion. Photographs will help in locating and identifying these items. Carefully check radiator inlets and headers for evidence of pitting impingement attack, or electrolytic action. Look also for cavitation action on pump impellers and other moving parts.

Arrange for daily control tests of cooling water, and obtain check samples of water for laboratory tests to confirm field results. Set up a system to obtain regular, controlled addition of treatment to the test locomotives; if possible, seal filler ports and tag them so that untreated water or improper treatment will not be added. If possible, cooling systems should be thoroughly cleaned and degreased before starting the tests. Caution personnel servicing the locomotives to avoid overflowing the cooling system when adding water, in order to prevent dilution of treatment. A careful log of engine

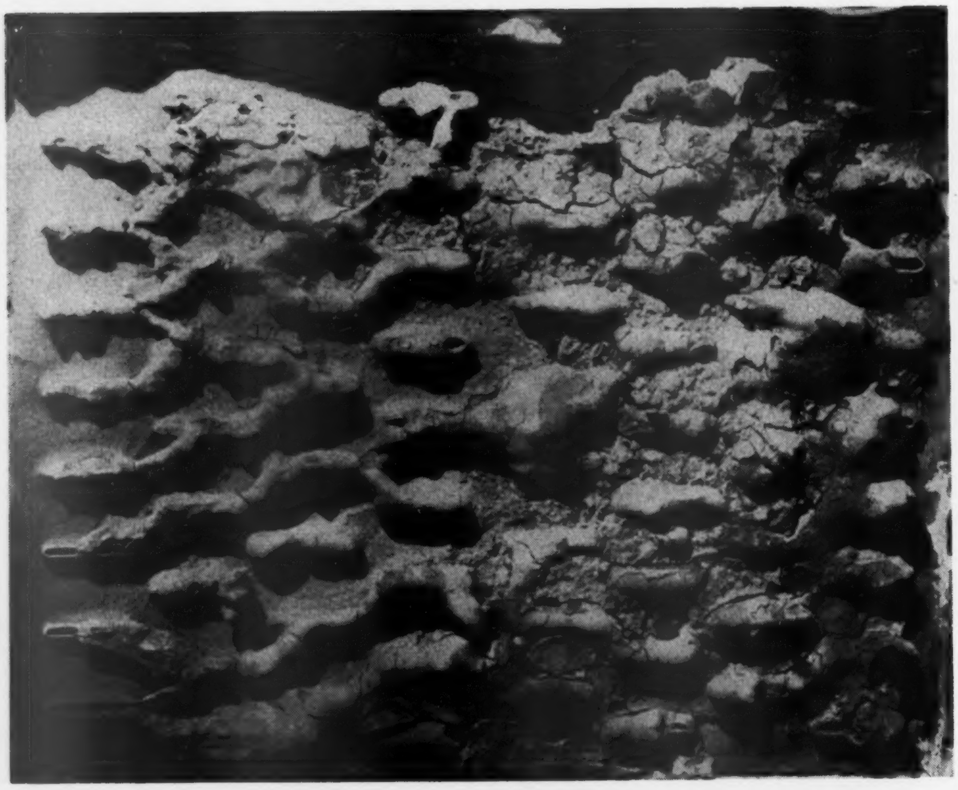


Fig. 7 — Diesel locomotive radiator clogged by metallic oxides, sludge and lint so that it has no cooling capacity.

performance, water addition, leakage and other data should be maintained, since they may have a definite bearing on test results. The tests should be followed closely, personnel from Test and Water Departments being assigned to supervise them. The physical appearance of the cooling water should be watched carefully, looking for evidences of oil, dirt or sludge accumulation in the system.

Control Test Methods—Laboratory And Field

The laboratory control tests now being used are based on borate and nitrite as tracer ions. For borate, a typical determination is the glycerol-sodium hydroxide titration of boric acid in an acidified solution of Formula 527. This is a slow and rather difficult procedure.

Nitrite determinations used are based on standard A.S.T.M. or A.P.H.A. procedures. These methods, which use either Napthylamine reagent or sulphamic acid, require extreme dilution of the samples, since the methods are designed to cover the range from 0 to 0.225 ppm. and the concentration of nitrite in treated cooling water is considerably higher.

A more simple and rapid procedure is direct titration of the cooling water against standard potassium permanganate solution. The sample of cooling water is placed in a 50 ml. burette. The burette tip is immersed in a measured, diluted quantity of potassium permanganate solution, and sample is added to a colorless endpoint. Titration multiplied by a factor gives the concentration of Formula 527. For precision results, the method may be modified slightly.

Field test methods most commonly used include conductimetric determinations, using a Concentrometer or Solubridge, and simple drop test titrations, based on alkalinity of treated cooling water. The determinations using the electrical instruments are subject to errors introduced by salts other than the treatment. Similar considerations exist with respect to the alkalinity titrations, which are subject to errors traceable to natural alkalinity of the makeup water. However, this is a serious problem only when using high alkalinity waters, such as those encountered in Western territories. Another colorimetric comparison method has been developed for field testing. This is a "go—no-go" test in which the sample plus color reagent is compared with color developed in standards set 10 per cent above and 10 per cent below the desired concentration. The color range developed is from green to orange; a properly treated sample should develop a color lying between these two. Instructions and procedures for all of these test methods are available upon request.

Effect Of Formula 527 On Lube Oil

The action of chromate cooling system treatments and substitute materials on lubricating oils is of considerable concern to railway test departments, and to oil companies. Considerable work has been done in the oil company laboratories to determine the effects of these materials on lubricating oils. The findings of three laboratories can be summarized as follows:

Sinclair Refining Company—Reports that chromate substitutes are virtually identical to chromate in their effect on lubricating oil. Up to 850 ppm, little effect of contamination by cooling system inhibitors was noted. At 2,000 ppm, the life of the lubricating oil is shortened appreciably. At 10,000 ppm contamination, viscosity changes rapidly, accelerated oxidation occurs and the life of the lubricant is estimated to be cut in one-half.

Standard Oil of Indiana—Reports that up to 1,000 ppm, Formula 527 exhibits negligible effect on lubricating oils. Above 1,000 ppm, however, oxidation accelerates, sludge and varnish forms. At 5,000 ppm the effect is very serious. (Determinations based on Indiana Sand Stirring Oxidation Tests, against copper, lead and iron.)

Research personnel at Standard Oil state that in their opinion, effect of cooling system treatments on lubricating oils comes from the sodium ion, rather than from chromate or various other anions in the formulations.

Texas Company, Beacon Laboratories—Have checked Formula 527, chromate type treatments, and various competitive materials, using the EMD silver corrosion test, the MacCoull oxidation test and modifications of the EMD test. Their results appear contradictory, but indications are that adverse results may be expected at contamination levels above 500 ppm, particularly when 2 per cent or more water is present.

Toxicity—Waste Disposal Problems

Damage claims or industrial dermatitis complaints instituted by railroad employees are seriously worrying railroad managements. In several damage claims skin irritation has been blamed on contact with chromate cooling system inhibitors or chromate residues in lube oils, among other materials. When evaluated by standard patch tests on several individuals, non-chromate Formula 527 does not appear to indicate unusual hazards. However, it is reported that one Western railroad is currently defending several dermatitis suits, blamed on the use of Boraxo hand soap. Therefore, although the reagents combined in Formula 527 are not considered hazardous, it is possible that future experience may indicate occasional, isolated sensitivity to this treatment, in line with average industrial experience with other standard inorganic chemicals. At present, however, the substitute materials have been used in field tests and widespread railroad service for more than three years, and no reports of skin irritation resulting from their use have been received.

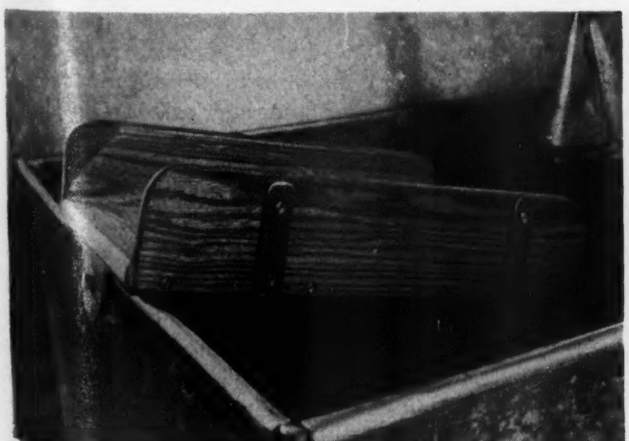
■ ■ ■

Shop Hints for Car Men

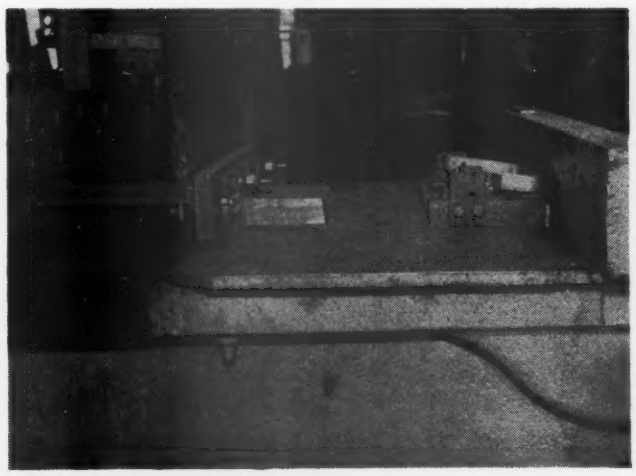
A recent tour of shops in the mid-west turned up three devices of interest to car men. Two are useful in heavy repair programs or in car building work while the third is for use primarily in conjunction with the light repair track. The latter is a box for making neat 3-in. by 10-in. rolls of packing. It is made of 1-in. lumber, has an overall length of 18 in., an inside height of 3 in. and an outside width of 10 in. It attaches to the waste bin through a set screw and is open at the near end for working the packing and at the far end to let the excess oil drain off.

Another road has substituted rotary dies for the shears of a rotary shears to put offsets in plate steel. This substitution permits the elimination of special dies for each different amount of offset. The arrangement can form offsets up to 48 in. away from one side and is particularly handy on long sheets, normally putting in a $\frac{1}{4}$-in. offset but with a capacity up to $\frac{3}{8}$ in. Guiding is done by rotating pins just above the dies.

Another use found for special dies is forming a sill step in two operations. A combination dies was developed for the job, which is done after heating the unformed steel to 1,600 deg. Referring to the illustration, the step is formed in the first operation by the large dies, which are tapered to bend the $1\frac{1}{4}$-in. offset in the steps. In the second operation the set is lifted to the position shown and the holes punched with the punching dies.



Box to form waste into rolls.



Combination dies for making sill steps.

Rotary dies for offsetting long steel plate.

Santa Fe diesel - powered passenger train pulling into San Bernardino, Cal., passenger station. Shops are across the yard at the right.

The Santa Fe's Diesel Motive Power

Comprehensive study of operation and maintenance over a period of 17 years basis of prize-winning paper before the Pan American Railway Congress.

THE Santa Fe, having severe operating conditions with respect to grades and boiler water problems on its western lines was a pioneer in the use of diesel-electric motive power. The history, development, operation and performance of this power was the subject of a prize-winning paper before the Pan American Railway Congress in June, 1953, by T. T. Blickle, mechanical superintendent, Coast Lines, Santa Fe. An abstract of this paper, with detailed statistical data relating especially to maintenance appears in two parts, in this and the October issue.

Mr. Blickle's paper started with the first 600 hp. switcher in February, 1935 and the first 3,600-hp., two-unit passenger locomotive in August, 1935, in the days of unfiltered air and oil and followed the progressive steps of the Santa Fe's dieselization to the end of 1952 at which time there were 1,410 units in servicing having a total rating of 1,951,785 hp.

Coverage is given to the following five major requirements for successful conversion from steam to diesel operation:

(a) Careful review of grade lines, weight of train to be handled, and desired schedules, to insure the selection of locomotives to suit best the operation with maximum utilization.

(b) Selection of locations for maintenance facilities for diesel locomotives, taking into consideration the greater mileage potential of this type of locomotive between running repairs, also the possible operating pools for locomotives to obtain maximum utilization when complete conversion is attained.

(c) Survey of all passing track facilities where single track operation is involved, to determine those requiring extension to accommodate longer trains, and those which might be eliminated as a result of reduction in density of train movement.

(d) Review of yard facilities to provide for trains of the size contemplated without interfering with normal switching operations.

(e) Training of personnel for the maintenance and operation of totally different equipments requiring greater technical knowledge and skill.

In discussing the selection of locomotives, Mr. Blickle has the view point, largely, of providing transcontinental service, over rugged grade lines. The majority of American railroads are concerned with somewhat shorter runs, and have more favorable grade lines. It is important, in deciding the question of motive power, that the characteristics and the limitations of the diesel-electric locomotive be thoroughly understood. Where long ruling

NUMBER AND TRACTIVE FORCE OF LOCOMOTIVES—ALL SERVICES—AT END OF YEAR

	STEAM			DIESEL				
				Number Owned			Tractive Force Pounds per	
Year	Number Owned	Total Tractive Force (thous. lb.)	Tractive Force (lbs.) per Loco.	Locos.	Units	Total Tractive Force (thous. lb.)	Loco.	Unit
1935	1,753	91,318	52,093	2	3	180	90,000	60,000
1936	1,727	90,498	52,402	3	4	229	76,333	57,250
1937	1,716	90,293	52,618	13	15	825	63,462	55,000
1938	1,644	87,413	53,171	20	24	1,277	63,850	53,208
1939	1,546	83,421	53,959	49	54	3,047	62,184	56,426
1940	1,477	79,408	53,763	53	61	3,438	64,868	56,361
1941	1,486	80,270	54,018	63	87	4,845	76,905	55,690
1942	1,500	81,645	54,430	82	139	7,782	94,902	55,983
1943	1,517	83,088	54,771	139	247	13,928	100,201	56,389
1944	1,560	86,808	55,646	199	391	22,261	111,863	56,934
1945	1,571	87,395	55,630	239	488	27,917	116,807	57,207
1946	1,567	87,210	55,654	247	518	29,724	120,339	57,382
1947	1,463	82,262	56,228	264	543	31,167	118,055	57,398
1948	1,380	78,775	57,083	313	644	36,567	116,828	56,781
1949	1,199	70,005	58,386	444	864	50,581	113,922	58,543
1950	1,055	62,656	59,390	508	967	57,025	112,253	58,971
1951	918	56,132	61.146	637	1,172	69,597	109,257	59,383

grades are involved, and it is essential that in excess of drag speeds of 12 to 15 miles per hour be maintained, or if the ruling grades are relatively light, a gear ratio suitable for both freight and passenger service may well be considered. Where the ruling grades are heavy and relatively short, but of a length to require operation beyond the locomotive short time rating, it is usual practice for freight service to provide gearing for the maximum continuous tractive effort available within the top operating speed allowed in freight service. It is apparent that each road requires an individual study to insure motive power best suited to its operation.

The training of maintenance and operating personnel is a major problem in the conversion from steam to diesel motive power, and this has been given thorough coverage by Mr. Blickle. The schooling facilities provided by the major builders in the past several years for the training of railway key personnel, supplemented with instruction cars available to the railways, have been of considerable value to the roads which have more recently entered into such conversion programs. Such schooling facilities were not available to the pioneers in this field. Many railways have now provided their own instruction cars, making possible a wider coverage of their employees.

Considering the vast change in the equipment when converting from steam to diesel electric, it is agreed that a well planned apprentice program is necessary. In view of the highly technical nature of many of the daily maintenance and operating problems, an organization can be substantially strengthened by including in the younger supervisory force men who have had foundation courses in mechanical and electrical engineering.

While testing out the first locomotive, it was apparent that a dynamic brake could be utilized to good advantage, and that a big saving could be realized in the elimination of damaged cars and stops for cooling the wheels, as well as the reduction of the number of wheels necessary to be removed due to excessive use of air brakes, and dynamic brake was designed for the first freight diesel-electric locomotive placed in service, and the majority of road locomotives delivered since that time have been equipped with dynamic brakes in order to obtain these savings, which have become more apparent every year.

Tests which were conducted to determine the effectiveness of dynamic brake in passenger service showed that approximately one ton of brake shoes could be saved in one trip over the railroad between Chicago and Los Angeles in high-speed passenger service by fully utilizing dynamic brake and using air brakes only as needed to supplement it.

Many changes have been made in the design of diesel locomotives since the first engines were placed in service, brought about by experience gained by the builders as well as the railroads. The first diesel-electric road locomotives had radiator air passing through engine room, allowing rain, snow, and dirt to enter. Steam generators did not have sufficient capacity to meet the requirements of the service. Engine lubricating oil pumps and cooling systems did not have sufficient capacity for desert operation. Traction motors did not have sufficient capacity for handling heavy trains and eliminate helper service.

When consideration was being given to the application of the diesel-electric locomotive as a prime mover for the Santa Fe, a system organization was set up for the handling of this work.

The position of supervisor of diesel engines was established September 1, 1935, to follow the field work covering maintenance, operation, changes in design, etc., and diesel maintainers were assigned to ride each locomotive.

These diesel maintainers were utilized to ride the locomotives on the road with the advent of the first diesel passenger locomotive in 1935, this being necessary because of the numerous difficulties experienced with the early locomotives and in order to have an experienced man with the locomotives at all times to give the engine crew the necessary instructions in regard to the proper operation of the locomotive. These men not only rode the locomotives on the road, but they also worked in the shop on their lay-over and assisted in making all types of repairs, both electrical and mechanical; the result being that these men received an all-round experience.

This program was continued in effect until 1944, at which time there was a total of 158 of these men in this service. During that time, sufficient headway had been made in improving the performance of the locomotives and acquainting the personnel with their use and maintenance that it was decided to discontinue having regular diesel maintainers ride each locomotive. The manpower situation was also critical during the war, and the services of these men could be better utilized at the various maintenance terminals.

When the practice was discontinued of having diesel maintainers ride each locomotive, certain of these men were assigned at key terminals and division points to ride and check on the performance of the locomotives, assist in such trouble-shooting as was necessary, and render necessary reports in regard to their performance

FREIGHT SERVICE DATA—SANTA FE DIESELS

Year	Installed During Year: No. Units	Installed During Year: Hp.	Availability	Utilization	Av. Mi. Per Mo. per unit	Lubricants Used—Gal.	Fuel Oil Used—Gal.
1939	.....	.....	.....	.....	.....	.....	.....
1940	2	2,700	.....	.....	.....	.....	.....
1941	18	24,300	89.95	66.23	.....	.....	.....
1942	48	64,800	89.08	73.39	6,990	211,388	10,147,771
1943	64	86,400	87.45	75.95	6,489	587,471	19,857,403
1944	112	151,200	84.93	76.85	7,728	693,079	40,707,447
1945	76	102,600	85.63	71.79	8,101	1,018,085	57,217,558
1946	.....	.....	.....	.....	9,296	1,038,086	37,190,784
1947	.....	.....	87.20	62.39	10,260	681,434	57,599,241
1948	10	16,000	86.89	61.92	10,516	718,501	61,777,406
1949	105	160,000	88.53	59.86	10,543	1,112,588	69,635,488
1950	68	102,000	89.27	58.29	9,096	1,400,882	99,676,978
1951	163	246,500	90.20	54.31	7,493	1,420,704	125,144,290
1952	175	265,500	.....	.....	.....	.....	.....
Total	841	1,222,000	.....	.....	.....	.....	.....

PASSENGER SERVICE DATA—SANTA FE DIESELS

Year	Installed During Year: No. Units	Installed During Year: Hp.	Availability	Utilization	Av. Mi. Per Mo. per unit	Lubricants Used—Gal.	Fuel Oil Used—Gal.
1935	2	3,600	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....
1937	2	3,600	.....	.....	.....	.....	.....
1938	9	16,200	.....	.....	.....	.....	.....
1939	2	4,000	.....	.....	16,783	98,561	3,926,928
1940	4	8,000	.....	.....	18,804	107,524	5,629,510
1941	5	10,000	.....	.....	18,270	132,090	6,998,915
1942	.....	.....	.....	.....	19,126	186,165	7,908,770
1943	.....	.....	.....	.....	18,087	193,515	8,059,493
1944	.....	.....	.....	.....	17,635	192,986	7,719,957
1945	.....	.....	.....	.....	17,295	192,769	8,484,917
1946	30	48,000	74.99	82.57	20,523	424,237	15,075,759
1947	21	42,000	76.54	82.05	22,392	552,771	34,730,706
1948	68	112,000	78.17	82.25	22,933	664,509	47,891,564
1949	50	75,000	80.96	79.78	23,216	924,669	60,834,579
1950	27	40,600	80.76	77.25	22,687	803,389	60,949,468
1951	12	18,000	83.39	75.71	22,823	835,926	61,641,731
1952	37	55,500	.....	.....	.....	.....	.....
Total	269	436,500	.....	.....	.....	.....	.....

SWITCHING SERVICE DATA—SANTA FE DIESELS

Year	Installed During Year: No. Units	Installed During Year: Hp.	Availability	Utilization	Av. Mi. Per Mo. per unit	Lubricants Used—Gal.	Fuel Oil Used—Gal.
1935	1	600	.....	.....	.....	.....	.....
1936	1	600	.....	.....	.....	.....	.....
1937	8	5,700	.....	.....	.....	.....	.....
1938	.....	.....	.....	.....	.....	.....	.....
1939	29	29,000	.....	.....	.....	.....	.....
1940	2	2,000	.....	.....	.....	.....	.....
1941	3	1,720	.....	.....	.....	.....	.....
1942	8	6,760	.....	.....	.....	.....	.....
1943	42	38,900	92.20	96.8	2,850	66,211	3,201,895
1944	30	28,080	92.40	95.7	3,400	108,268	4,833,934
1945	21	21,000	92.20	89.9	3,302	109,126	5,687,126
1946	.....	.....	91.07	90.25	3,587	131,013	6,355,784
1947	4	4,000	91.54	89.10	3,520	135,054	6,860,903
1948	24	24,000	91.88	87.97	3,301	148,881	7,370,199
1949	64	61,525	91.61	87.15	3,469	395,463	9,278,216
1950	7	8,200	91.77	80.97	3,319	492,009	11,670,419
1951	30	32,000	91.56	81.00	3,235	494,796	11,522,311
1952	26	29,200	.....	.....	.....	.....	.....
Total	300	293,285	.....	.....	.....	.....	.....

and maintenance. This program is still in effect, these men carrying title of assistant supervisors of diesel engines, and they have been instrumental in the resulting diesel locomotive performance on the Santa Fe. Many of the men who previously had this experience are now holding key supervisory positions in practically all categories.

Some of these men are college graduates with engineering degrees; however, the majority of them started with the railroad as apprentices, and nearly all of them have put in their entire working life on the Santa Fe.

The first diesel repair facility was built and placed in service at Chicago in 1939 to take care of the first diesel locomotives assigned to the Super Chief and El Capitan trains. Later on it also took over maintenance of the engines assigned to the Chicagoan and Kansas Cityan trains, as well as the Tulsan, and continued to handle maintenance on all diesel passenger locomotives operating in and out of Chicago until this work was taken over at Barstow, California.

In additional to Chicago, four other major maintenance terminals have been established for diesel locomotives, these being Barstow and San Bernardino, California, Cleburne, Texas, and Argentine, Kansas. Barstow was selected as a major diesel servicing terminal because of its being geographically located as a hub for our diesel operation, as both freight and passenger locomotives are dispatched in three directions out of that point; namely, north to Oakland, California, south to Los Angeles, and all points east. A new diesel shop was built there in 1945 and with the additions which have been made there since then, it now consists of seven inside servicing tracks, two outside servicing tracks, and two inside tracks for truck and wheel work. There was also recently completed at Barstow a new locomotive sanding and washing facility. The washing facility includes vertical rotary brushes for washing the sides of the locomotives, and also high-pressure jets located alongside and in between the rails for washing both sides of the wheels and underneath the locomotives and trucks.

As of the end of 1952, 529 units were assigned to Barstow for maintenance. For the 12-month period November 1, 1951, to November 1, 1952, Barstow handled 8,345 switch and road switch type locomotives, 10,619 freight locomotives, and 6,691 passenger locomotives, this work consisting of servicing and running repairs; all annual inspections and heavy repairs being handled by our San Bernardino shop.

To do this work, 91,709.1 manhours were utilized of the various crafts, working 24 hours per day, seven days per week, there being approximately 700 men assigned to this work as of the end of 1952.

During peak business periods, it is necessary to dispatch as many as forty-eight 6,000-hp. freight locomotives out of Barstow each 24 hours, in addition to eight or ten passenger locomotives. All main line freight locomotives in service west of Clovis, N.M., are maintained at Barstow; also all mainline passenger locomotives working between Barstow and Oakland, San Diego, Los Angeles, and Chicago, Chicago to Galveston, Texas, and Clovis to Houston, Texas, are maintained at Barstow and operate in a pool out of there.

The shop at Barstow was a new shop built exclusively for diesel work, and none of the existing steam facilities at that terminal were converted for diesel locomtive work.

At San Bernardino, California, was located one of the largest steam locomotive shops which was converted to diesel work to handle the annual inspections, wreck repairs, and the general overhauling of locomotives and their various parts. This includes complete rebuilding of all types of diesel engines, main generators, and traction motors, as well as smaller motors and generators. Many parts are also manufactured in this shop, and with the reconditioning program which has been placed in effect at San Bernardino for reconditioning parts sent in from all over the railroad, it has brought about a substantial reduction in repair costs.

As of the end of 1950, there were 710 diesel units assigned to San Bernardino for annual inspection and general repairs, and approximately 1,000 men performed this work. They also handle the running maintenance

MAN HOURS WORKED ON DIESEL LOCOMOTIVE BY CRAFTS—BARSTOW, CALIF. DIESEL SHOP

Date	Machinist	Electrician	Sheet metal workers	Boilermakers	Blacksmiths	Carmen	Laborers	Totals
November 1951	40,518.0	16,011.7	3,747.0	866.5	24.4	1,480.8	15,671.5	78,319.9
December, 1951	41,234.6	16,585.1	3,806.3	632.0	13.0	1,457.3	17,960.0	81,688.3
January, 1952	42,878.5	17,842.6	3,918.8	627.1	11.0	1,444.4	18,931.9	85,654.3
February, 1952	38,971.2	15,922.0	3,606.6	508.0	20.0	1,255.3	16,782.2	77,065.3
March, 1952	41,246.9	16,812.0	4,147.7	665.5	30.0	1,508.2	17,745.2	82,155.5
Apr l, 1952	41,759.0	16,442.2	4,423.3	756.0	24.0	1,400.6	15,935.9	80,741.0
May, 1952	41,986.1	16,537.2	4,196.6	682.0	22.0	1,564.3	16,055.3	81,043.5
June, 1952	41,246.2	16,433.6	4,164.8	782.3	26.0	1,420.8	20,287.0	84,360.7
July, 1952	42,271.6	18,367.1	4,386.6	1,677.3	35.7	1,598.6	21,001.9	89,338.8
August, 1952	41,722.1	17,427.8	4,521.2	1,523.3	32.0	1,460.5	15,029.8	81.716.7
September, 1952	43,789.7	18,519.8	4,522.7	1,155.8	22.2	1,442.5	15,950.4	85,403.1
October, 1952	48,710.5	19,923.6	4,605.9	1,549.6	26.0	1,604.4	15,289.1	91,709.1

and the I.C.C. inspections on approximately 50 of these units. To accomplish this work for the 12-month period November 1, 1951, to November 1, 1952, required 1,503,-563 manhours of the various crafts working five days per week, two shifts per day. With the large volume of work assigned to this shop and the large number of annual inspections which must be performed each year, and the resulting work connected with them, it has been necessary to establish production schedules for this shop.

New Devices Increase Efficiency

In order to do the necessary work and meet these schedules, many devices and methods have been developed by the shop forces which resulted in increased efficiency. Sketches are available of many of these devices, and anyone interested in them is extended a cordial invitation to visit the shop and obtain first-hand information regarding them, and necessary drawings will be furnished upon request.

Cleburne, Texas, located on the southern part of the railroad, is a former steam locomotive repair shop which has been converted for diesel work. As of the end of 1952, it was handling running repairs and servicing on approximately 300 units and the annual inspections on approximately 140 units, with reconditioned diesel engines, generators, and traction motors being furnished from San Bernardino shop as needed, as well as certain other smaller items.

The freight locomotives maintained at Cleburne are operated south to Belleville Yard, a distance of 211 miles, north to Chicago, a distance of 1,068 miles, with some units making a complete circle from Cleburne to Argentine, La Junta, Colorado, Denver, and Sweetwater, Texas, returning to Cleburne, a distance of approximately 2,463 miles.

These freight units receive monthly inspections at Cleburne and some of them semi-monthly inspections at Argentine due to the fact that it is not possible to get them back to Cleburne in time for semi-monthly inspections, making it necessary that this work be handled at Argentine.

The Work At Other Shops

Argentine, in addition to handling the above mentioned semi-monthly inspections on approximately 300 units assigned to Cleburne, also handles the running repair and servicing on 46 other units, which includes 35 switchers. A new diesel facility is now being constructed at Argentine which will have capacity for handling 600 units operating in that territory when completely dieselized, this shop to take care of running repairs, servicing, and annual inspections, as well as heavy repairs.

The Need for Proper Lubricating Oils

Originally straight mineral oils were used on the Santa Fe, and in later years there has been a decided trend to heavy duty additive oils, some of which have caused considerable difficulty. Heavy duty oils have been utilized only in such engines as was found actually needed them, and the bulk of the Santa Fe diesel power still uses the straight mineral oils. A check of the performance would indicate that their use has been successful, and probably more economical due to the price of differential which has existed between the two types of oils.

Experience has indicated that regardless of what type oil is used, the most important thing is to keep it free from carbon water, and fuel oil accumulations. To do this, sufficiently frequent filter change periods are necessary in order to get the filters changed out before the oil becomes dirty. Also, periodical checks must be made for dilution and to detect the presence of water in the oil.

On the Santa Fe, the blotter test is used to determine when the oil is getting dirty. Visgage is used to detect fuel dilutions, and visual inspection of the top deck and interior crankcase by experienced personnel is made for detecting indications of water which is readily apparent by the sweating of the interior or of the lubricating oil system if there is any appreciable amount of water in the oil.

When engines have been shut down for quite some time, the bottom of the crankcase is drained before starting in order to determine if any water has leaked into the oil. This program has been in effect on the Santa Fe Railroad since 1945 and has been very successful and has kept crank shaft failures from becoming exececessive.

Originally, lubricating oil was changed each 10,000 or 12,000 miles when locomotives were first placed in service. As the size of the diesel locomotive fleet increased and experience was gained, it became very apparent that such handling was very uneconomical and unnecessary, and in 1945 the program which was just outlined was placed in effect, and since then the only time oil changes have been made was when the oil had become contaminated or it was necessary to perform work on the engine necessitating draining the oil, or at the time of annual inspection.

The first diesel locomotives placed in service were not equipped with engine air filters or lubricating oil filters, the result being that the unfiltered air and oil caused excessive wear and many failures, and it was necessary to equip the engines with air filters and lubricating oil filters of adequate capacity to overcome this trouble. As a result of this, many types of air filters and oil filters came into the field, the majority of which were very inadequate, and it was several years before locomotives

started coming from the builders equipped with lubricating oil filters of sufficient capacity to filter the oil.

Due to the many types and sizes of lubricating oil and air filters which came on the market, it resulted in considerable problem to the railroads in handling them. In order to overcome this, a program was worked out for ardization of air filter element sizes and proper lubricating oil filter sizes so that they would be interchangeable on the various types of locomotives.

It was 1941 before locomotives came equipped with car body filters in order to filter all the air going into the engine rooms and keep the dirt out of the equipment which caused considerable difficulty, especially with the electrical equipment. This car body filter application was more or less mainly confined to the road type locomotives. It has been only in the last year or so that manufacturers have started to make car body filter installation on road switcher type locomotives.

Experience has shown that the elimination of dirt getting into the equipment on diesel locomotives is one of the most serious and important problems to contend with, and the application of filters to properly filter the air is a necessity. In order to obtain the desired results, even after the filter applications are made, the filters must be properly cleaned and oiled with specially developed air filter oils at frequent intervals in order to properly filter the air and is one phase of diesel locomotive maintenance which must be carefully policed to obtain the advantages inherent with it.

It is also necessary that proper air filter cleaning and

TYPE OF WORK PERFORMED AT BARSTOW, CALIF. ON DIESEL-ELECTRIC LOCOMOTIVES—12-MONTH PERIOD

	1951		1952										
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
DIESEL UNITS ASSIGNED													
Switch (Road)	40	37	17	10	5	5	6	6	6	6	6	6	150
Switch (Yard)	7	8	9	7	8	8	8	8	8	9	9	9	98
Freight	·304	304	296	292	282	282	289	280	280	286	290	290	3,475
Passenger	182	182	184	184	184	184	184	190	184	185	185	212	2,240
TOTAL UNITS	533	531	506	493	479	479	487	484	478	486	490	517	.....
LOCOS. HANDLED													
Switch (Yd. & Road)	598	694	667	636	826	693	685	692	734	730	689	701	8,345
Freight	975	936	928	805	902	860	915	931	769	740	902	956	10,619
Passenger	578	578	563	532	608	563	544	526	525	616	523	535	6,691
INSPECTIONS HANDLED													
Switch (Yd. & Road)													
(a) Daily	300	341	372	290	341	341	310	302	310	341	330	341	3,919
(b) Monthly (Includes quarterly and semi-annual)	47	45	24	17	11	13	14	14	14	14	14	14	241
Freight—Units													
(a) Trip	2,653	2,676	2,496	2,286	2,614	2,586	2,282	2,731	2,152	2,115	2,603	2,623	29,817
(b) 10-Day	148	192	238	200	209	178	177	179	186	182	297	415	2,601
(c) Monthly (Includes quarterly and semi-annual)	400	358	357	376	368	334	349	317	307	292	342	306	4,106
Passenger—Units													
(a) Trip	306	261	280	281	319	320	311	290	248	179	300	277	3,372
(b) 4500	307	278	295	307	325	274	346	344	328	333	309	356	3,802
(c) 10,000	260	316	309	283	268	291	284	266	300	320	274	256	3,427
(d) Monthly (Includes quarterly and semi-annual)	245	232	246	208	268	225	220	208	227	218	251	268	2,816
TRUCK WORK PERFORMED													
Single wheel assy. chgd.	236	239	230	203	219	189	218	227	261	293	261	230	
Trucks chgd. (2 pr. power whls. to trk.)	41	51	39	47	38	29	32	15	12	5	7	3	319
Traction motors chgd.	305	326	297	283	280	235	269	244	272	284	265	222	3,282
Pr. wheels turned	265	285	295	235	270	195	193	234	214	220	208	184	2,798
Power whls. chgd.	305	326	297	283	280	235	269	244	272	284	265	222	
Idler whls. chgd.	13	15	11	14	15	12	13	13	13	19	10	14	
GRAND TOTAL WHLS. CHGD.	318	341	308	297	295	247	282	257	285	303	275	236	3,444
STEAM GEN. WORK PERFORMED													
Acid washed	248	241	246	232	221	224	222	223	253	237	254	302	2,903
Coils changed	14	13	27	10	15	14	18	9	8	9	4	9	150
DIESEL ENGINE WORK													
Cylinder heads chgd.	167	132	87	146	119	133	144	114	95	123	135	144	1,539
Cyl. assemblies chgd.	58	110	74	119	112	65	84	66	82	99	96	108	1,073
Alco exh. manifolds	1	0	0	0	0	0	2	2	6	9	7	4	31
Alco turbo superchgrs.	3	0	0	1	0	0	3	1	5	2	7	4	26
Lube oil changes	17	15	20	18	13	18	25	16	18	12	13	32	217
FILTER WORK-ELEMENTS HANDLED													
Lube oil filters renewed	6,724	6,716	6,560	6,484	6,436	5,396	5,384	5,932	5,932	5,964	7,060	7,492	76,080
Air filters cleaned	14,532	14,524	14,272	14,132	14,052	14,060	14,008	14,008	14,008	14,084	14,900	15,440	172,020
Fuel oil filters renewed	1,646	1,640	1,559	1,526	1,502	1,508	1,505	1,505	1,505	1,514	1,526	1,607	18,543
Fuel oil filters cleaned	3,822	3,818	3,722	3,672	3,642	2,776	2,766	2,766	2,766	2,784	3,690	3,852	40,076
ELECTRICAL ITEMS													
(a) Dynamic braking grid renewals	4	2	8	15	1	0	1	3	2	1	10	5	52
(b) G. E. governors	0	1	0	1	0	4	1	0	1	1	1	3	13
(c) Automatic train control work													
1. Units equipped	93	93	93	93	93	93	93	93	93	93	93	105	1,128
2. Inspections													
Monthly	64	64	61	63	63	61	63	61	64	63	63	67	757
Quarterly	15	15	16	15	16	16	15	16	15	16	15	16	186
Semi-annual	7	7	8	8	7	8	8	8	7	7	8	8	91
ATC gov. overhauled and rewired	32	38	28	27	37	39	34	25	41	35	30	39	405
(d) Train stop work													
1. Units equipped	94	94	94	94	94	94	94	94	96	102	106	112	1,168
2. Monthly inspt.	94	94	94	94	94	94	94	94	96	102	106	108	1,164
3. Receivers overhauled	17	12	13	10	24	10	8	16	23	10	14	22	180
(e) Traction motors cleaned and inspected at wheel shop	264	280	256	251	247	210	247	194	223	230	228	184	2,814
(f) Vernathern controls overhauled and tested	24	22	24	37	61	50	51	35	20	25	40	43	432
(g) Power contactors overhauled and tested	16	12	14	16	15	16	12	10	16	15	14	16	172
(h) Main generator brushholders overhauled	135	150	140	128	122	124	144	156	120	160	160	140	1,679

oiling equipment be made available at maintenance terminals so filters can be properly serviced.

The diesel locomotive air filtering problems have been further improved the past few years by the development and application of special car body grilles which separate a good portion of the dirt from the air before it enters the air filter, thus providing better filtration. These grilles also have somewhat the same effect on snow and eliminate, in many instances, a considerable amount of snow from entering engine rooms. All new locomotives now being built have these grilles more or less as standard equipment.

Providing clean fuel oil for diesel locomotives is also an important problem and has caused considerable difficulty many times in the past due to the fuel oil containing water and foreign matter. For this reason, it is important that the diesel fuel storage tanks be properly equipped for draining out water and prevent it from being pumped into diesel locomotives, and that the diesel fuel oil be well filtered before it is placed in diesel locomotive supply tanks. When this is done, little difficulty is experienced with stoppage of fuel filters on the locomotives, allowing them to run a long time between cleanings.

Another problem with fuel oil has been the difficulty experienced with the fuel congealing at low temperatures. In many instances where fuel oils of sufficient low pour point cannot be secured and furnished, it has been necessary to equip the diesel locomotives with special fuel oil heaters to overcome this condition. In some cases the heat is obtained from the engine cooling water and in other instances from the engine exhaust.

Improper diesel fuels will cause considerable difficulty and, in many cases, expensive repairs. In order to overcome this, a periodical analysis should be made of fuels being furnished, to determine how they compare with established specifications. Whenever it is found that such fuels deviate very far from these specifications it is important that steps to taken to remedy same; otherwise, it is liable to result in failures and costly repairs.

[Part II will appear in October and deal in detail with maintenance operations.—Editor]

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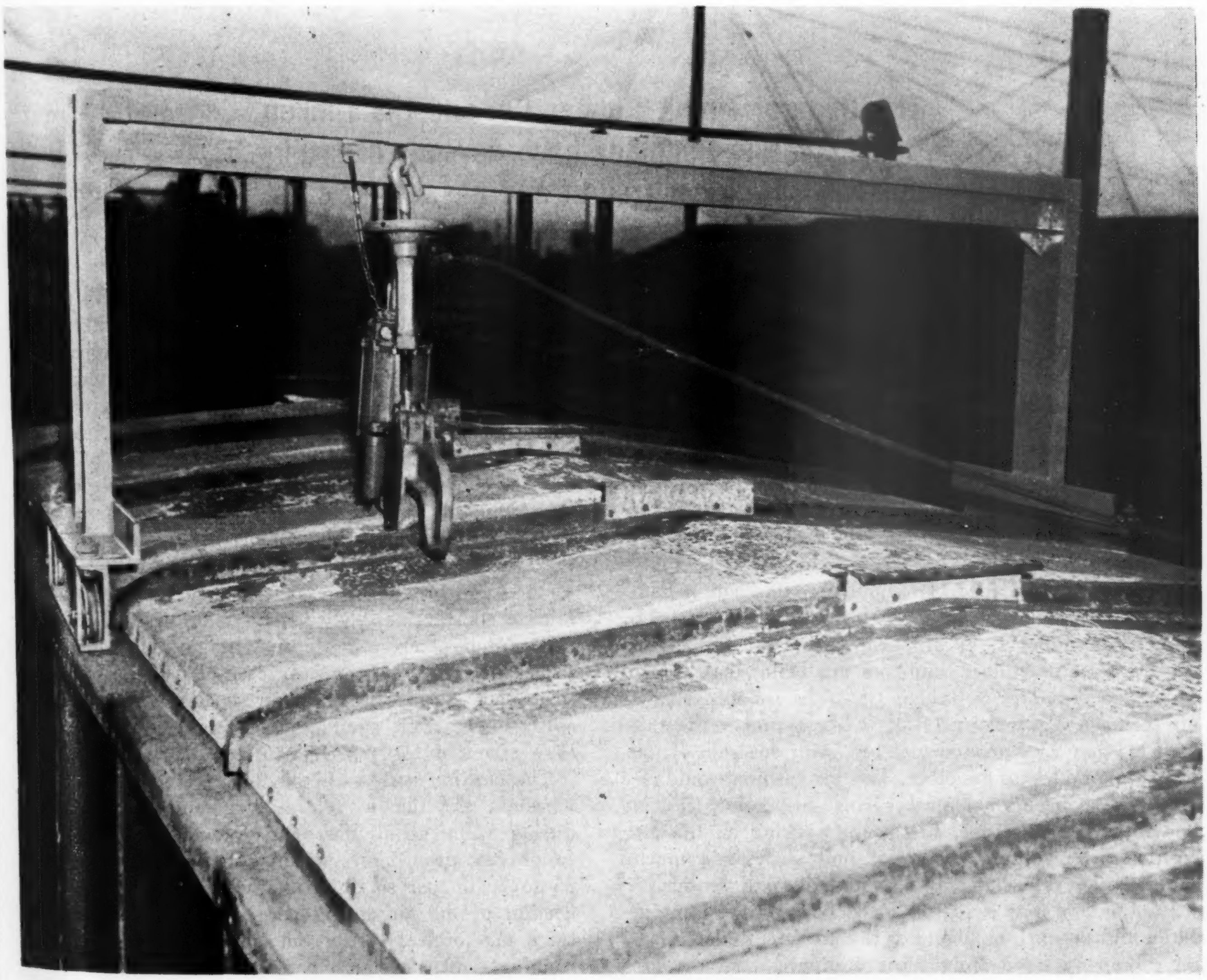
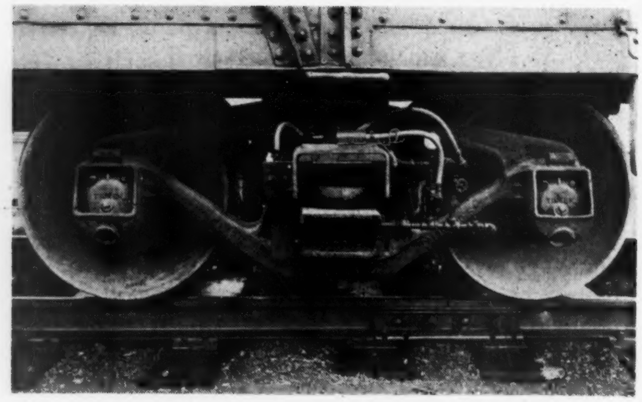


Squeeze-type riveter and traveling support for riveting freight car roofs.

Air cells shown in position on the "spring plank" without the truck bolster.



Air cell mounted in the truck of a freight car showing the air piping from the brake system.

"Air Cells" Are the Latest Freight-Car Springs

The General Tire & Rubber Co. and the Timken Roller Bearing Company have developed an air-cushion spring for freight and passenger cars.

If ultimate results prove to be as successful as preliminary tests indicate railway passenger and freight cars actually riding on air may soon be a reality. A joint development of the Goodyear Tire & Rubber Co. and the Timken Roller Bearing Company, is the air spring described in this article.

Most freight and passenger cars in use today are equipped with standard steel coil springs. When traversing a rough stretch of track, vertical oscillation or recoil action will result with cars so equipped.

This action is most severe when a freight car is empty or only partially loaded. To counteract this action both freight and passenger cars are being equipped with shock absorbers, snubbers, or elliptical springs, and freight-car trucks with built-in snubbers are being installed.

The General Tire & Rubber Co. has developed a new air spring which looks very much like a rubber life raft with the gunwales pressed together, with one side of the raft riding on top of the other. This air cushion would replace the conventional steel spring suspension system under the truck bolster. Engineers working on the air cushion believe that it will not only provide a much softer, easier ride, but may also make braking easier.

Preliminary tests were conducted between the Canton, Ohio, and Gambrinus plants of the Timken Roller Bearing Company on a freight car equipped with the air cushion spring, mounted in a modified conventional Timken-bearing-equipped freight truck. Sensitive recording devices were attached to a car equipped with the air cushion and also to a similar freight car equipped with standard coil springs. The recording and measuring devices showed that vertical oscillation was greatly reduced both in amplitude and frequency, making for a soft, easy ride. Since the up-and-down jolting of freight cars is one source of damage to lading, such damage should be substantially minimized.

The air cushion spring obtains its air pressure from the brake pipe. Air is fed into the rubber bellows of the air cushion through an automatic regulator which maintains a constant car-body height, regardless of the load.

The chances are remote for a freight car so equipped to be "hung up" en route. In case of damage to the air system of the spring, rubber shock pads within the springs take over, enabling the freight car to continue to a terminal for repairs.

The cushion spring air valves have three stages—one to admit air, one to release air, and a neutral stage during which no air passes in or out. Air pressures on freight-car air-cushion springs will probably range from 35 to 70 lb. per sq. in. with the car fully loaded. Deflection of the air spring per pound of load is about twice that of leaf springs on a fully loaded car. When running light, deflection per pound of load is four or five times that of leaf-spring suspensions.

Programs of the Coordinated Associations

THE Coordinated Mechanical Associations—Air Brake, Car Department Officers', Locomotive Maintenance Officers', Master Boiler Makers', and Railway Fuel and Traveling Engineers'—will meet at the Hotel Sherman, Chicago, Monday through Wednesday, September 14-16. Paul Feucht, president, Chicago & North Western, will be the guest speaker at the Presidents Luncheon at noon, Tuesday, September 15. The subject of his talk will be "Progress Is Not Self Made." The Electrical Section, Engineering and Mechanical Divisions, A.A.R., will not join in these sessions, its meeting having been held at Atlantic City in June. There will be no exhibit.

Air Brake Association

MONDAY, SEPTEMBER 14
10:00 a.m.

Address by President R. F. Thomas.
Secretary's report.
Handling Air-Brake Equipment and Material—Central Air Brake Club.
Multiple Capacity Brakes for Freight Cars, by G. L. Cotter, chief executive in charge of engineering activities, Air Brake division, Westinghouse Air Brake Company.

2:00 p.m.

Stopping Freight Trains from Rear, by F. R. Ellis, air-brake instructor, Reading.
Paper by Pittsburgh Air Brake Club.
Report of Approved Maintenance Practice Committee—24-RL Equipment, by F. W. Dell (chairman), GTW.

TUESDAY, SEPTEMBER 15
9:00 a.m.

Air Brake Know How Pays Dividends, by J. V. Ellsworth, New York Air Brake Co.
Address on Apprenticeship Training by L. B. George, assistant chief motive power and rolling stock, CPR.
Report of Committee on Standardization of Air Brake Equipment for Diesel and Turbo Electric Locomotives, by A. M. Malmgren (chairman), general diesel and air brake supervisor, StL&F.
The Brake Pipe Flow Indicator—Manhattan Air Brake Club.

2:00 p.m.

Train Handling and Trouble Shooting (Joint session with RF&TEA).

WEDNESDAY, SEPTEMBER 16
9:00 a.m.

Operating with Automatic Train and Speed Control, by J. W. White, general foreman (mechanical), PRR.
Assembling, Inspection and Testing of Locomotive Brakes Prior to Service—St. Louis Air Brake Club.
Air Compressor Lubrication—National Railroad Lubrication Committee.

2:00 p.m.

Completion of papers and discussions of committee reports.
Election of officers.
Discussion of subjects for 1954 program.

Locomotive Maintenance Officers' Association

MONDAY, SEPTEMBER 14
10:30 a.m.

Address by D. S. Neuhart, general superintendent motive power and maintenance, UP. Subject: Gas Turbine Locomotive Maintenance and Operation.
Address by E. L. Duggan; superintendent of safety system, AT&SF. Subject: Spot-Lighting the Accident Prevention Program.

2:00 p.m.

Report of Committee on Diesel Personnel Training—E. V. Myers (chairman), superintendent motive power, StLSW. Subject: Methods Used to Train Personnel for Maintaining Diesel Locomotives.
Report of Committee on Diesel Electrical—W. P. Miller (chairman), assistant to chief mechanical officer, C&NW. Subject: Flashovers—Rewiring Diesel Locomotives.

TUESDAY, SEPTEMBER 15
9:00 a.m.

Report of Committee on Shop Practices—C. H. Spence (chairman), superintendent of shops, B&O. Subject: Inspection and Maintenance of Diesel Wheels, Axles, and Roller Bearings.

3:00 p.m.

Special review of diesel locomotive maintenance industries. Arranged and conducted tours for L.M.O.A. members only.

WEDNESDAY, SEPTEMBER 16
9:00 a.m.

Report of Committee on Shop Planning—E. L. Neeley (chairman), superintendent of shops, UP. Subject: Scheduling and Flow of Work in Centralized Diesel Shop.
Report of Committee on Diesel Mechanical—J. W. Luke (chairman), general supervisor diesel engines, AT&SF. Subject: Diesel Engine Lubrication Maintenance Problems.

2:00 p.m.

Address by Allyn C. Breed, acting director, Bureau of Locomotive Inspection.
Report of Committee on Diesel Material Reconditioning and Control—H. J. Anderson, welding instructor, NYC System. Subject: Economical Reclamation of Diesel Locomotive Parts.

Master Boiler Makers' Association

SUNDAY, SEPTEMBER 13
4:00 p.m.

Meeting of Executive Board.

MONDAY, SEPTEMBER 14
10:00 a.m.

Address by President H. R. Barclay.
Report of the Executive Board.
Financial report.

2:00 p.m.

Message by Secretary-Treasurer Albert F. Stiglmeier.
Message by G. L. Ernstrom, general mechanical superintendent, NP.
Report on Topic No. 3—Study and Recommendations and

Methods of Treating Water for Diesel Locomotive Cooling and Steam Generator Feedwater System.
Report of Committee on Law.

TUESDAY, SEPTEMBER 15
9:00 a.m.

Report on Topic No. 1—Recommended Practices for the Cleaning, Inspection and Testing of Steam Generator Coils to Determine Their Condition and Eliminate Failure.
Message by R. B. Russell, supervisor, Bureau of Safety, CPR.
Report on Topic No. 2—Study and Recommendation for the Washing and Cleaning of Diesel Locomotive Water Tanks.
Election of officers.

2:30 p.m.

Report on Topic No. 4—Study and Recommendations for the Welding and Brazing of Individual Diesel Locomotive Parts as well as the Hard Facing of Wearing Parts.
Message by Allyn C. Breed, assistant director, Bureau of Locomotive Inspection.
Message by H. R. Cawley, mechanical assistant, Board of Transport, Commissioners for Canada.

WEDNESDAY, SEPTEMBER 16
9.00 a.m.

Report of Committee on Memorials.
Report of Committees on Resolutions.
Report on Topic No. 5—Recommended Good Practices for Preparing Steam Locomotive Boiler at Monthly Inspection to Enable It to Remain Away From Home Terminal for 30-Day Period.
Report on Topic No. 6—Inspection and Maintenance of Air Reservoirs on Steam and Diesel Locomotives With Special Reference to Standardization of Washout and Inspection Plugs.

Car Department Officers' Association

MONDAY, SEPTEMBER 14
10:00 a.m.

Address by President A. H. Keys, superintendent car department, B&O.
Report of Committee on Analysis of Train Yard Operation, C. E. Dyer, terminal supervisor car maintenance, C&NW.
Address by W. C. Baker, vice-president, operation and maintenance, B&O.

2:00 p.m.

Report of Committee on Interchange, and Billing for Car Repairs, C. W. Kimball, supervisor car inspection, Southern.
Report of Committee on A.A.R. Loading Rules, A. H. Petersen, superintendent car department, Belt Railway of Chicago.

TUESDAY, SEPTEMBER 15
9:00 a.m.

Report of Committee on Wheel Shop Practices—E. W. Kline, general wheel shop foreman, B&O.
Address on Human Relations, by F. J. Goebel, vice-president (personnel), B&O.
Report of Committee on Car Lubrication—H. J. Baker, superintendent car department, C&O, PM district.
Comments by W. M. Keller, director, mechanical research, Association of American Railroads.

2:00 p.m.

Report of Committee on Expeditious Handling of Repairs to Loaded or Empty Foreign and System Light Repair Cars—A. J. Larrick, regional master car builder, B&O.
Report of Committee on Air Conditioning Equipment—Operation and Maintenance—C. Manzelman, air-conditioning and electrical foreman, CMStP&P.

WEDNESDAY, SEPTEMBER 16
9:00 a.m.

Report of Committee on Maintenance of Passenger Car Equipment—J. F. Swafford, assistant master mechanic, Washington Terminal Company.
Address on Car Department's Contribution to the Safety Effort, by F. R. Callahan, director, Bureau of Safety and Compensation, Pullman Company.
Report of Committee on Painting—Recent Developments of Maintenance Painting of Railway Equipment—F. M. Vogel, painter foreman, D&RGW.
Miscellaneous reports.
Election of Officers.

Railway Fuel and Traveling Engineers' Association

MONDAY, SEPTEMBER 14
10:00 a.m.

Address by President R. D. Nicholson.
Secretary's report.
Safety in Railroad Operation, H. G. Conner, general safety supervisor, B&O.
Education of Engine Crews, Diesel Locomotives, J. S. Swan, supervisor locomotive operations, L&N.
Business session.

2:00 p.m.

Fairbanks Morse Diesel Locomotives and Engines (with slides), C. H. Morse, Jr., manager, diesel locomotives, service department, Fairbanks, Morse & Co.
Vapor Steam Generator—Operation and Trouble Shooting (with slides), G. C. Scott, Sr., service assistant to vice-president, Vapor Heating Corp.
Coal and Oil Burning Steam Locomotives, A. O. Scott, regional locomotive fuel supervisor, CN.

TUESDAY, SEPTEMBER 15
9:00 a.m.

Design Developments of General Motors Diesel Locomotives (with slides), E. L. Formento, school instructor, Electro-Motive Div., General Motors Corp.
Smoke Abatement, R. G. Norton, supervisor, smoke abatement, N&W.
Employee and Public Relations, by W. T. Wilson, assistant vice-president, CNR.
Address by D. B. Jenks, executive-operating vice-president, CRI&P.

2:00 p.m.

Passenger-Train Handling; Freight-Train Handling; Dynamic Braking, A. M. Malmgren, general diesel and air-brake supervisor, StLSF. (Joint session with Air Brake Association.)
Slid Flat Wheels on Diesel-Electric Locomotives (yard and road), R. H. Francis, general road foreman equipment, StLSF.

WEDNESDAY, SEPTEMBER 16
9:00 a.m.

Loss and Damage Due to Rough Handling, C. A. Naffziger, director, Freight Loss and Damage Section, Association of American Railroads.
Elesco Steam Generators (with slides), C. A. Leet, Superheater Co.
Panel discussion by S. Lodge, Alco-G.E.; E. L. Formento, Electro-Motive Div., General Motors Corp.; J. J. Gardner and W. B. Thornton, Baldwin-Lima-Hamilton Corp.; C. H. Morse, Jr., Fairbanks, Morse & Co.

2:00 p.m.

Results of election.
Conservation of Diesel Fuel, T. J. Conway, fuel supervisor, T&P.
Diesel Failures and Remedies, J. R. Weller, supervisor locomotive operation, B&O.

Courtesy Bethlehem Steel Company

Wheel Shops—Equipment and Operation

Wheel and axle work is important from the labor-saving standpoint, but still more important from a safety standpoint. Shop equipment of the right kind can contribute much toward both these ends.

By R. H. HERMAN

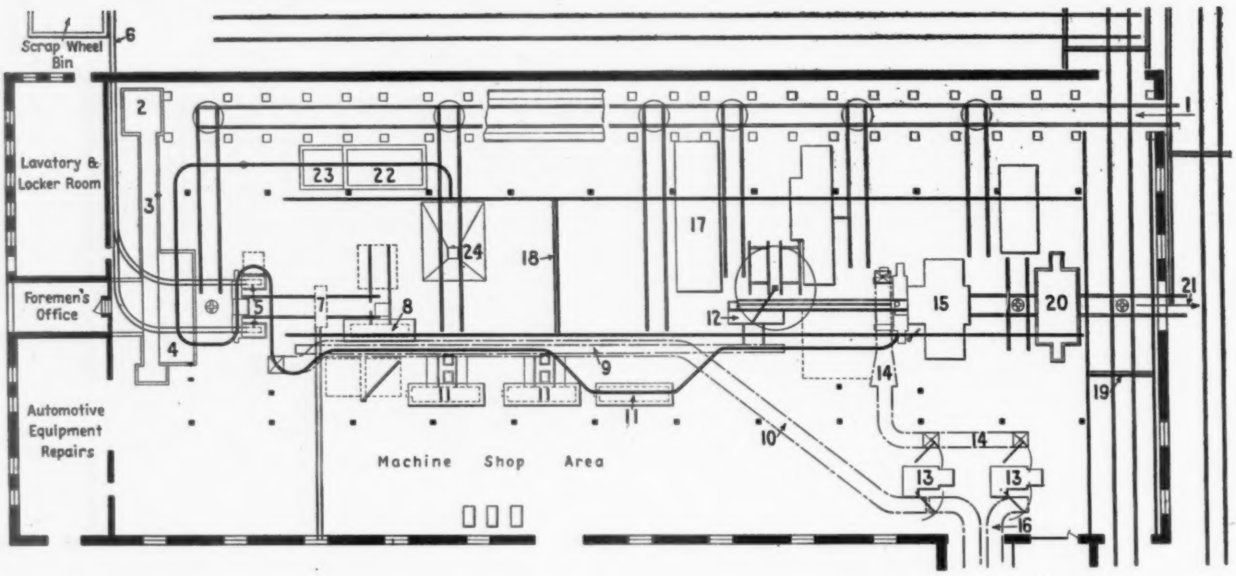
[Mr. Herman, who is engineer shops and equipment of the Southern, is the author of the section on Wheel Shops which will appear in the forthcoming edition of the Car Builders' Cyclopedia. This article is taken from a more comprehensive treatment dealing with wheel shops in that publication.—Editor.]

THE introduction to the February, 1951, issue of the Wheel and Axle Manual published by the Association of American Railroads aptly designates wheel and axle work as one of the most important subjects in the Mechanical Department of American railroads. It is important that every effort be made to establish and maintain the best practices in wheel shop work. An even more important factor is safety since wheel and axle failures not only cause property loss but may endanger human life as well.

Wheel Defects

Wheels and axles are removed from service and sent to the wheel shop for two general reasons; either they are worn to the prescribed limits or they show a defect that requires removal from service. When a wheel pair (referred to in this section as descriptive of an axle upon which is mounted two wheels) is removed from a truck for shipment to the wheel shop a wheel tag or some similar form of marking is used to indicate the reason for removal. Upon arrival at the wheel shop a further inspection is made to determine whether the condition is such that wheels are to be dismounted, journals turned on wheel pairs of treads turned on steel wheels which determines the route the wheel pair should take through the shop. While the original basis for removal may have been wheel defects, careful inspection at the wheel shop frequently develops that the axle also is worn beyond limits. An accompanying table shows the various wheel and axle defects together with the AAR symbols which are universally used to designate each specific defect.

Consideration has been given on many railroads to the desirability of turning one wear wrought steel wheels. The practice varies—on some railroads they are turned



whenever condition permits while other railroads will not attempt to turn them.

If the one wear steel wheel does not take either a remount or road gauge it does not require turning, even though slightly worn. However if it takes either the remount or road gauge it must be turned before it can be used provided sufficient metal will remain after the turning operation. Otherwise it is scrap. The conditions for turning and reuse of a one wear steel wheel are detailed in the Wheel and Axle Manual.

Wheel Shop Operations

After the wheel pairs, received at the wheel shop, have been inspected and marked as to disposition they travel through the shop in different directions, depending upon the nature of the operations to be performed. The percentages of the several operations to the total vary widely on different railroads. One shop, for example, may be designated as a freight car wheel shop handling only cast iron or one wear steel wheels. Journal turning and tread turning on wrough steel wheel pairs may be performed at another location. Another shop may handle only passenger car or diesel locomotive wrought steel wheels which will require somewhat different equipment and operating procedures.

Layout and Arrangement

The design and construction of some recent wheel shops indicate clearly that wheel shop operations can be placed on an efficient low-cost basis by the use of modern machinery and conveying devices—without in any way sacrificing quality. It is essential that careful studies be made and detailed layouts prepared before starting construction of a new or modernizing an existing shop.

Most wheel shops that are modernized—in some cases, even when new—are, in the interest of economy adapted to an existing building, or possibly to a restricted land area. From the standpoint of ultimate efficiency a shop built under such a handicap may be far from ideal as regards output per day and cost per wheel pair. With the rapidly increasing cost of labor, if output requirements are to be met at a reasonable cost the shop must be well arranged; have efficient, modern handling equipment; have high capacity machine tools, in good condition and with modern tooling equipment. Above all it must be provided with supervision that can utilize both men and machines toward the end of maximum output per man employed.

Many existing wheel shops are still working with obsolete slow speed machines and equipment. It is highly desirable and more profitable to retire wornout and obsolete machines and replace them with modern machines which, over a comparatively short period of time, will more than pay for themselves in labor savings and in production.

With modern machinery and equipment capable of two or even three shift operation in a new or modernized shop it is possible to centralize wheel and axle work and by doing so, secure a better class of work, greater production and appreciable savings on the overall job. One or two strategically located, well equipped and modernly fitted wheel shops will readily displace a dozen wheel shops equipped with old, worn out equipment.

In the new or modernized central wheel shop, the handling of wheels, axles and wheel pairs requires exhaustive studies. Too many existing wheel shops are decidedly inadequate from the standpoint of handling facilities—with the result that manual labor must be used for movement of wheels, axles and wheel pairs. A well-designed and well-equipped wheel shop is not the back-breaking type of shop and, because good handling facilities are provided, the number of men—and the man-hours—needed is reduced while the shop output is increased. Too many shop men, and many shop engineers, are deceived by the relationship between floor-to-floor time and machining time. In most shops there is a big difference but in a well-equipped shop there should not be.

Consider the matter of boring mills as an example. If a boring mill is to have an output capacity of 100 wheels per shift it means that the average floor-to-floor time cannot possibly be over 4.8 minutes per wheel. Actually it is not practical to estimate on the basis of eight full hours of work; seven and one-quarter or seven and one-half hours per shift would be more logical

A Modern Wheel Shop Designed for an Output of 200 Pairs of Wheels

(See drawing on opposite page)

This shop, which occupies a building 140 ft. by 300 ft. employs a force of 17 mechanics and 7 helpers on the day shift and 9 mechanics and 2 helpers on the second shift can turn out about 180 pair of wheels a day, including 100 pairs of new freight car wheels.

Incoming wheel cars with defective wheel pairs are placed at the end of the shop under an overhead crane runway. Wheels unloaded from the car by the overhead crane using Hepenstall automatic lifting tongs are placed on tracks leading into the shops from Positions *1* or *21*. Wheel pairs for demounting are placed at *1*, on the outside end of an overhead incline which extends the full length of the shop. Thus, approximately 100 pairs of wheels are stored on the overhead track ready for automatic demounting without further handling. They are released one at a time to elevator *2* and conveyor *3*, run by the weight of the wheel pair and controlled by a small motor, which brings each pair in turn to the 600-ton demounting press *4*. The press has an interlocked hydraulic elevator to lower the wheel pair into place and lift them out.

The wheel pairs roll out of the demounting press to a shop built arrangement 5, where the wheels are moved sideways into automatic elevators which raise them and kick the loose wheels into long overhead rolling inclines *6* through the shop wall to one of four pre-selected bins outside the shop. Good wheels for reboring are placed on a horizontal roller wheel conveyor *10* and move automatically back to the boring mills. If they are needed immediately they are carried by a fork lift truck.

Each bad order axle is raised by a floor air cylinder electrically controlled and rolls into the cleaning machine *7*. The cleaning machine was shop built for automatic wire brush cleaning of the axle body between wheel seats. After cleaning the axle is kicked out and rolls to the automatic cycling centering machine *8* and rolls through after centering onto a pallet conveyor *9*. Axles may be handled on and off the pallet conveyor by the machinist who runs the axle centering machine, the machinists who run the end drive axle lathes *11* or the Magnaglo machine *12*. The controls are electrically interlocked and any one of the above mentioned mechanics can handle the axle, or a number of axles into and out of his machine without leaving the machine. All axles after machining are rolled back on the pallet conveyor, inspected in the self-cycling Magnaglo machine, then sorted according to journal sizes and a list of sizes of wheel fits is compiled and sent to the boring mills *13*.

Axles are inspected on the rack following 5 and if condemned they roll through the cleaning and centering machines and onto the pallet conveyor which carries them to scrap axle storage racks.

Wheels are bored to wheel fit sizes and sent down a roller conveyor *14* to an automatic upender and pre-mounter, this being actuated when a pre-selected axle has been sent to the wheel press *15* on a self powered transfer dolly. The operation of the upender and the transfer dolly is so timed that the pressman can mount one pair of wheels before another pair is pre-mounted and waiting for him. The mounting press is through type with oil gear pump and electro-pneumatic control.

After the wheels are gaged, they roll along a track through the grinder *20* for grinding passenger car and diesel wheels are required.

Diesel locomotive wheel assemblies and wheel pairs sent into the shop for tread or journal turning are unloaded at *1* and roll into the shop on a track at floor level. By means of flat roller bearing turntable they are rolled onto the proper track for attention.

Diesel wheels are lifted into the cleaning tank *22*, are washed off at pit *23* and drained over a floor level grating at *24*. Journal boxes are removed, bearings inspected and cleaned in the area adjacent to *24*.

Wrought steel wheel pairs requiring tread turning roll to a new Sellers profiling car wheel lathe at *17* and when completed are moved by overhead crane to the outgoing track across the end of the building.

An end drive axle lathe adjacent to the wheel mounting press and grinder turns journals on all mounted wheel pairs. An automatic loading device with elevator permits rolling wheels into and out of the journal turning lathe without manual handling.

Two 6,000 lb. fork lift trucks are used for miscellaneous lifting operations throughout the shop. A 10-ton diesel 2 powered crane equipped with a boom and lifting magnet loads out scrap wheels.

The shop is equipped with one two-ton 29 ft. span underhung crane with floor control *18*, moving lengthwise of the shop. This crane has a hoist arranged to operate when desired off the crane rail to the monorail system which in general extends in loops from the cleaning tank to the dismounting press, around the scrap wheel elevators and down the line of the axle conveyor with an offset to one of the axle lathes used mostly for passenger car and diesel wheel work.

A second two-ton crane *19* with 17 ft. span equipped with operating cab is installed transversely in the outgoing end of the shop and is used for loading wheel cars. Two outside tramrail cranes with 40 ft. and 20 ft. spans for wheel handling are of two-ton capacity.

Two gravity roller conveyors *16* on which new wheels enter the shop for boring, are enclosed and steam heated so that wheels will be at proper temperatures when they reach the boring mills.

All key machines are checked periodically. Micrometer calipers, both dial type and direct reading are also checked for continued accuracy using standard micrometer gage blocks. Special gages for measuring journal length, collar height, wheel seat length and setting height of cutting tools are made easily available.

Carbide insert cutting tools are used almost exclusively for machine tools in the shop. Tool inserts are accurately ground on a tool grinder using a small 6 in. diamond dust abrasive wheel. With tool and machine conditions maintained as nearly perfect as possible, tool breakage is minimized and high cutting speed with full accuracy assured.

so that the practical average floor-to-floor time becomes 4.5 minutes per wheel. Inasmuch as the actual machining time may be less than one minute out of the 4.5 minutes, it is obvious that the handling facilities must be of the best, in order to pick up a wheel, place it on the table, chuck it, set the boring tools and when the machining is completed, pick up the wheel, remove it from the table and place it on the floor or conveyor in 3.5 minutes. The new designs of hydraulic wheel boring mills are capable of turning out 100 cast iron or 60 to 70 steel wheels in an eight-hour day if the proper tools are used and the handling equipment is properly designed and installed.

While all shop planning engineers have as their goal an efficient practical shop arrangement, their final plans for a projected new facility may vary widely in type of equipment selected, arrangements of conveyors and other details. One engineer may have justifiable objections to a particular make or type of machine that others use extensively and the same thing may apply to conveying

An example of a 600-ton demounting press installed on its side at shop floor level.

systems. He may also have to complete the new facility on a limited appropriation, or on the basis of expected savings can plan on having sufficient money for a fully mechanized arrangement involving appreciable expense.

Unloading and Handling Wheel Pairs

Most railroads transport wheel pairs in special cars designed and regularly assigned for wheel service. Such cars are usually built in the railroad's own shops using flat cars or salvaged underframes from other classes of freight cars. Longitudinal members of steel plate, structural steel or even timber have cut out sections or pockets to suit the shape of the wheel. The wheel pairs are placed in these pockets, overlapping adjacent wheel pairs similar to the position on double wheel storage tracks. A standard flat car will accommodate approximately 20 wheel pairs in a single layer. Railroads have developed many ingenious arrangements for increasing the car capacity up to 48 wheel pairs. Blocks, anchors, clamps or additional supports are necessary for all wheel pairs not carried in the pockets of the longitudinal members.

The method of loading is important on double-decked wheel cars and has a vital bearing on the layout of the storage tracks for incoming wheels at the wheel shop.

A desirable arrangement is to provide a combination loading and unloading track of sufficient length to accommodate all the cars to be received in a 24-hour period. If we assume six cars of wheels are received and shipped out in that period the track should have a minimum length to accommodate 18 cars. A switch engine can place the six cars of defectice wheel pairs at one end. Then the cars can be moved from one position to another until all wheel pairs are unloaded and new or reconditioned wheel pairs loaded, when the car should have reached the end of the track.

At the first position all wheel pairs with condemned wheels or axles should be unloaded to storage tracks leading to the demounting press, at the second position wheel pairs for journal turning and at the third position wheel pairs for tread turning. Loading of wheel pairs which have had treads or journals turned would be accomplished at the fourth and fifth positions and new or second hand wheel pairs at the sixth position. As each car is loaded it is moved into the clear at the end of the wheel car track.

A diesel or steam powered locomotive crane from 10 to 25-ton capacity operating on a parallel track with long boom is used in many wheel shops for handling wheel pairs. Equipment of this type involves an appreciable expenditure, is limited in its travel by the track layout, requires an operator, a fireman if steam powered, and a ground force of two to three men. Many modern wheel shops are using gasoline or diesel powered rubber tired crane trucks, 6,000 to 10,000 lb. capacity for loading and unloading wheel pairs.

An overhead traveling crane on a runway, an electric hoist on a monorail arrangement and a pillar type or a jib crane have all been used with success.

Unloading and Handling Axles

New axles can be unloaded from cars to storage racks by locomotive type crane, mobile crane truck, fork lift trucks, crane or hoist depending on type of car and method of loading. New storage racks should be designed with separate tiers for each size and type of axle, and arranged to feed axles into shop as required.

Scrap axles from the demounting press should be conveyed to a location where they can be loaded into cars for shipment to the scrap dock.

One shop has an arrangement where the loose wheels and axles roll out of the press with dollies to hold the wheels upright and move them away from the axle. The axle itself is lifted by an electric hoist and placed on a four-tiered steel rack which is inclined so the axle rolls to the axle centering machine where it is recentered and the wheel seats calipered. It then rolls through the machine to another rack and is moved from there to axle racks feeding each machine.

After axles are turned they are moved on a push button controlled pallet conveyor to the burnishing lathe, then to the inspection station and finally to the mounting press. Handling of axles in and out of lathes is done by a jib crane with an electric hoist.

Regardless of the handling equipment some means should be provided for cleaning all second hand axles before they start through the shop. Many schemes have been developed ranging from hand cleaning, placing the axle in a lye vat, sand blasting or grit blasting the body of the axle, flame cleaning with oxyacetylene or wire brush cleaning. The cleaning machine can be arranged so that the axle rolls in and out with no manual handling and by relatively simple controls all functions can be made automatic.

Unloading and Handling Loose Wheels

Loose wheels may be received in gondolas, box cars or special wheel cars which provide racks and blocking to hold wheels in an upright position. They can be unloaded by rolling them manually, by mobile crane truck or by a fork lift truck. Several railroads have equipped the fork truck with a hinged bar. The two forks are pushed under the flanges of five wheels and the bar dropped down to hold the wheels upright. Then the forks and wheels are raised several inches and the truck carries them to the desired location.

The fork truck can also be equipped with a bar replacing the forks. This bar is shoved through the bore and when elevated several inches lifts the wheels. Both methods are in satisfactory operation.

New wheels after unloading are stacked upright in rows outside, segregated as to kind and tape sizes.

One wheel shop is equipped with gravity type roller conveyors leading from the outside of the building, through the wall to one side of each boring mill. Wheels are loaded onto this conveyor by a hinged lift section arranged for pneumatic or hydraulic operation. The boring mills have two side mounted cranes. One lifts the wheel off the roller conveyor onto the table while the other lifts it off the table after boring and places it on another roller conveyor which carries it to the wheel press. In lieu of a roller conveyor, one wheel shop is provided with an inclined chute. Wheels are loaded into the chute by an elevator and roll into the building to a special wheel delivery device at the boring mill. A similar inclined chute leads from the boring mills to the wheel press. Arrangement for handling loose wheels from demounting press should be as nearly automatic as possible.

Wheels which have been dismounted but which can be reused can be handled from the demount press to storage or boring mill by hand rolling, fork lift truck, roller wheel conveyor or by monorail or overhead crane. These will be relatively few in number and consist mainly of wrought steel wheels removed because of a defective axle.

Demounting Wheels from Axles

The most efficient and satisfactory arrangement for demounting is the use of a high-speed hydraulic duoble-cylinder press. One such unit, rated at 600-tons capacity, is designed for installation below floor level, with an elevating device to lower wheel pairs into place. Wheels are demounted in 40 seconds and, by use of an elevator the total in- and out-time is not much greater.

Another unit of vertical design, also rated 600-ton capacity and hydraulically operated, has two cylinders mounted together in the center, with ram movements in opposite directions. The wheel pairs are rolled into the press from one side, the wheels pressed off in turn and the loose wheel and axle assembly rolled out the same side.

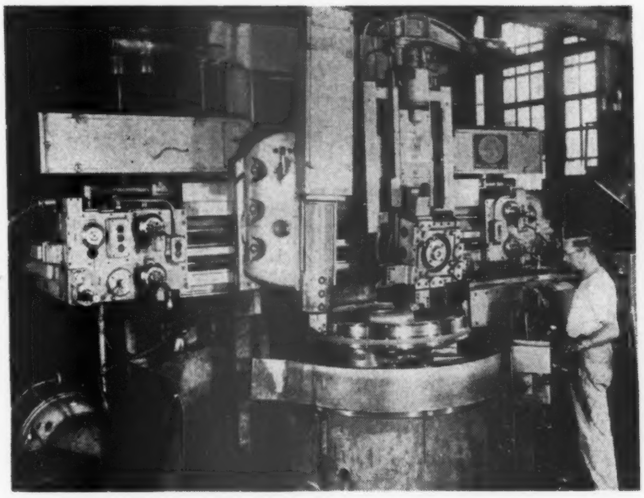
One railroad has developed a satisfactory high speed single end arrangement by removing the rear end cross beam and replacing the single acting triplex pump with a motor-driven rotary pump for greatly increased operating speeds. A wheel pair is rolled into the press and the ram pushes one end of the axle as the near wheel is held by the center beam. One man rolls the wheel pair out and the other man takes the loose wheel and rolls it to the disposal chute while the first man turns the axle and one wheel assembly and rolls it back into the press. As soon as the second wheel has been pressed off one man takes the loose wheel while the other picks up the axle with a hoist and places it on a rack.

Boring New Wheels

Boring mills for boring cast iron or wrought steel wheels have a table with a five jaw automatic centering chuck. The boring column is hydraulically operated on a fully automatic cycle with adjustable settings to permit rough boring at one speed, slow down, finishing at another speed, chamfering and then return to top position.

These machines may be equipped with a manual or hydraulic feed hub facing attachment or a hydraulically operated side head for machining passenger car or diesel locomotive wheel hubs.

The boring mill can be provided with an electric or



The finishing of new wheels requires extreme accuracy and this automatic vertical turret lathe saves time and labor.

pneumatic wheel hoist on one or both sides to handle wheels in or out of the machine. Tooling can be either carbide or high speed steel as desired. At one shop the average time to bore a cast iron wheel is 5 minutes and a steel wheel 8 minutes on a machine of this type.

Another design of car wheel boring mill features a rotating boring bar which is fed into the hub of a stationary car wheel. Two tables each with a five-jaw self-centering chuck operate on ways so that one table is always in position under the boring bar while the other is being loaded and unloaded. With this arrangement as many as 43 cast iron wheels have been bored in one hour.

Diesel wheels require additional operations since both sides of the hub must be machined to close tolerances for the dust and water guards. This work can be done on a standard car wheel boring mill with a hub facing attachment, or with a hydraulically operated side head with turret tool post. A 54 in. vertical turret lathe using a five-position turret and a side head has also proven satisfactory for production machining of these wheels.

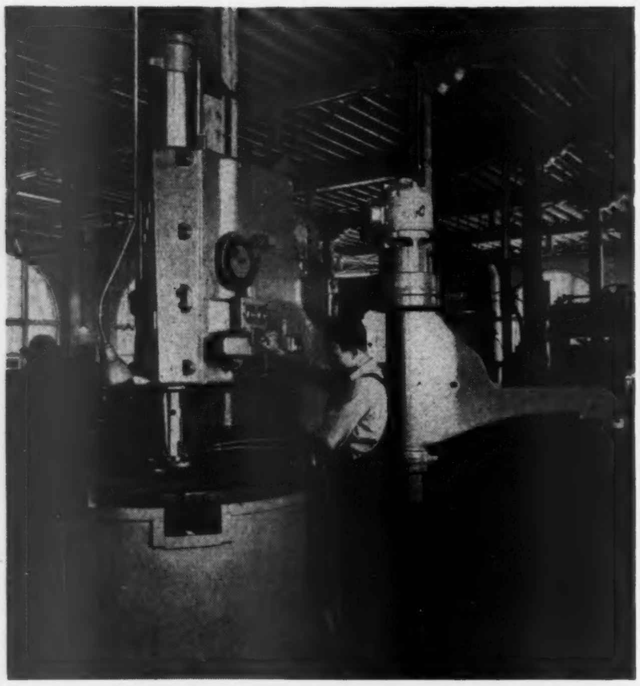
Machining Axles

The modern design of the center drive axle lathe features anti-friction bearings in headstock, tailstock and driver chuck and is capable of high-speed operation using carbide tools. One shop reports an average production of 10 to 12 axles in 8 hours.

The problem of machining diesel locomotive or streamlined passenger car axles from rough turned blanks is vastly different from machining freight car axles which normally do not require turning the body of the axle between wheel seats. The severity of the service required of these axles necessitates particular attention to the surface condition of all highly stressed steel parts and many railroads grind the axles all over after they are machined.

One method of doing this work is to use a 24 in. heavy duty engine lathe with a profiling attachment and carbide tooling. A round or flat template supported on brackets at the back of the lathe guides a tracer which in turn controls the movement of the carriage by hydraulic cylinders to the exact contour desired.

The axle is turned slightly oversize and is then placed in a grinding machine and the entire axle or such portions as necessary are ground to finish size.



An example of a modern car-wheel boring mill with wheel-handling equipment.

The journals of freight car axles must be rolled or burnished to a fine smooth finish after machining. Burnishing lathes have been developed, with anti friction bearings throughout, an end drive arrangement and two carriages each holding two opposed rollers, with equalizing screws. The roller feed is either by hand wheel or hydraulic cylinders. Average output on a machine of this type is 48 axles on an eight hour shift. The modern design end drive axle lathes can also be equipped with dual opposed equalizing rollers so that the turning and burnishing operations can be performed on one machine, eliminating extra handling.

The new design end drive axle lathe is furnished with both headstock and tailstock raised to swing 49 in. over the bed. The two carriages are arranged for swivel type tool holders, carbide tooling and opposed burnishing rolls. Due to its design a simple shop built loading arrangement is possible and production with one operator will be 20 to 25 wheel pairs in eight hours.

Grinding Treads on Wheel Pairs

A modern design car wheel tread grinder is a desirable feature in a quality production shop. It can be used to grind treads on passenger car, diesel locomotive and wrought steel freight car wheel pairs and in many cases for cast iron wheels.

In one shop the practice is to grind all car wheels after they are turned. In order to conserve service metal tread-worn-hollow wheels are placed in the wheel lathe, the flanges cut down to the proper contour and height and the outer edge and the tread turned down leaving the original wearing surface at the center. These wheels are then placed in the wheel grinder and the tread surface is ground just enough to true up the wheels. It is estimated that at least 1/8 in. of metal per wheel is saved by this operation as compared with turning the entire wheel contour in a wheel lathe.

The car wheel lathes previously used as standard equipment in the wheel shop for turning wheels to correct defects such as flat spots, sharp flanges, tread worn hollow, built up tread and high flanges were slow speed units designed for high speed tooling. The two carriages each had a compound tool slide and four position tool holder for high speed forming tools. Production with a machine of this type was limited to four pair of diesel locomotive wheels and possibly as many as 11 pairs of 33 in. wheels in eight hours.

These machines now use a 100-h.p. motor and speeds suitable for carbide tooling. They can be furnished with a profiling attachment with templates having the correct wheel tread contour. The carriage is hydraulically operated and controlled by the tracer. A machine of this type will regularly turn 15 to 16 wheel pairs in eight hours.

Inspecting for defects

The simplest method of testing axles for defects by the Magnaflux method is to use a power unit in conjunction with loops of secondary cable which are passed over the journals and wheel seats while dry powder is blown or sprinkled on the area to be tested. This arrangement is slow and time consuming for bare axles although used in most cases for testing journals on mounted wheel pairs.

The production shop should be provided with an axle testing bench with one or two movable coils hand or power driven so they travel from one end of the axle to the other. The test may be made by dry powder, a solution with Magnaflux paste or by the Magnaglo method. The last has proved most satisfactory and sensitive for axle testing.

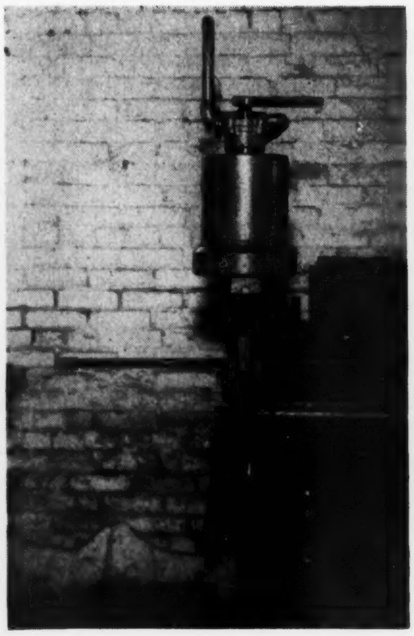
The most efficient arrangement comprises a Magnaglo testing machine, with pump for the solution and a power driven carriage in conjunction with a loading and unloading arrangement whereby axles feed into and roll out of the machine without manual handling.

Mounting wheels on axles

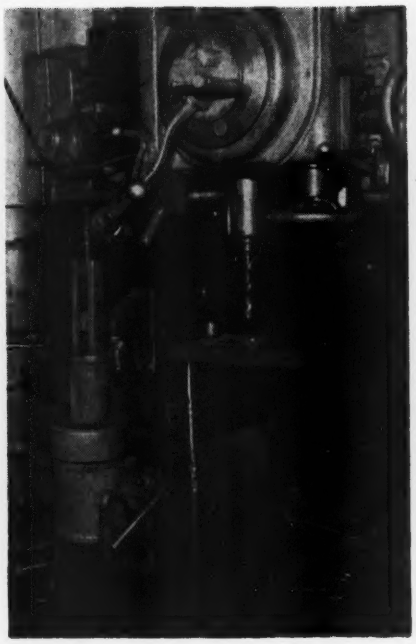
Several designs of high speed double and hydraulic wheel presses, specially designed for mounting only are now available which greatly reduce the time required for this operation. One press of efficient design, rated at 300 or 400 tons has a motor driven rotary pump with a hydraulic system providing ram speeds of 88 in. per minute advance, 12 in. per minute pressing and 130 in. per minute return. Only one main cylinder is used but an ingenious arrangement of blocks and yokes operated by pneumatic cylinders permits pressing on both wheels, one after another, without turning the assembly and then rolling the wheel pair through the press.

A number of shops use a special wheel assembly device in conjunction with the above wheel press by means of which the wheels are lifted from the conveyor by an overhead crane using a special hook which raises the wheels from a horizontal position to a vertical position in the air. They are then placed in dollies which support them upright. The axle is positioned on a jack and protecting collars placed over the journals. The wheels are moved onto the ends of the axle, the jack is lowered and the entire assembly is rolled into the wheel press. While pressing the wheels on one pair a second set of wheels and axles can be assembled for rolling into the press.

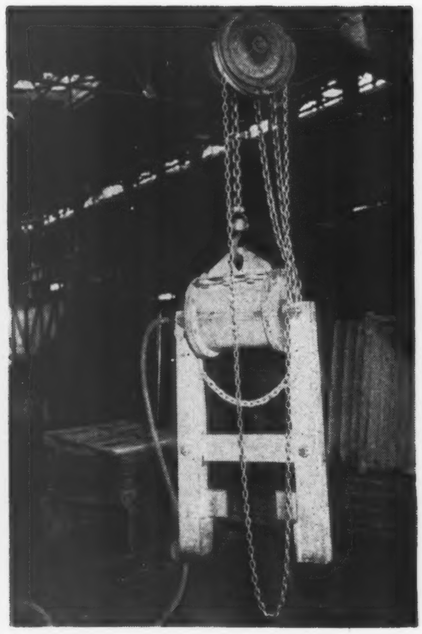
Average time for pressing on one pair of wheels is 1 min. 5 sec. with the above arangement.



Air vise clamps pipe quickly and securely.



Air clamp applied to a radial drill press.



Friction-block-spring compressing device.

Five Air-Operated Gadgets Used in Car Shops

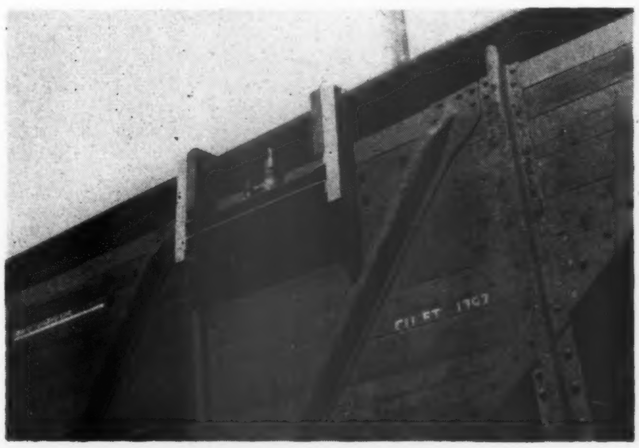
The versatility of air as an operating medium for shop tools to make the work easier and safer is illustrated by five devices developed in shops of several mid-western railroads. One of the devices compresses the friction block springs on the truck bolster of ride control trucks. It compresses the spring and wedge assembly and holds it compressed long enough for the insertion of pins which keep the assembly compressed until the bolster is applied to the truck side frame.

Two air clamps have also been found to be a quick and safe method for holding materials for different shop operations. One of the air clamps has been applied to a radial drill press for holding in place brake jaws, side bearings, bell crank fulcrums and other miscellaneous small parts which require drilling. The clamp operates through a simple lever system with the force applied by a 5-in. air cylinder mounted on the side of the drill press.

The second example of the use of air for quick and secure clamping is to a pipe vise which holds pipe from $\frac{3}{8}$ in. to $1\frac{1}{4}$ in. for threading and coupling. The pipe rests on two jaws mounted to a steel bench, and the holding force is applied through a third jaw directly connected to the piston rod of a 6-in. air cylinder.

Another road uses a 15-ton air jack in conjunction with a simple stand to straighten the top bulb angles on hopper cars. The top of the vertical members of the stand are notched out, and the jaws formed by the notches fit around the bulb angle. After the bulb is heated, the air jack is set on the bottom of the stand for straightening the section of the bulb angle between the jaws.

An air motor has been found to be handy for re-centering axles in another shop. To do this an arrangement has been built with three hinged legs and a feed screw. The legs fit around the journal through a protective piece of soft material which prevents scratching the journal. The legs are held moderately snug against the journal by sliding toward the axle a triangular member which fits around all three legs. The air motor is fed for the re-centering operation by turning the feed screw with the legs contacting the axle collar to keep the holding arrangement in place.



Air jack and stand to straighten top bulb angles.

Recentering axles with an air motor.

Seller's profile-cutting wheel lathe as installed at the Jackson street, St. Paul, shops of the Great Northern

Wheel lathe controls and cutting operation.

Profile-Cutting Wheel Lathe

By J. H. Heron*

The Great Northern recently placed in operation at its Jackson street wheel shop, St. Paul, Minn., a modern high-speed, carbide-tool, automatic-profiling wheel lathe. With the advent of this machine, the mounted wheel-turning output of the shop has been increased threefold. The machine uses a 100-hp. main drive motor and has ample power and speed to utilize any advances in tooling that may be made in the coming years. The machine is believed to be the first of its kind to be equipped with an automatic chip conveyor. The average machining time on a pair of wheels is about twelve minutes.

The new Sellers 50-in. automatic profiling wheel lathe has many advanced features which eliminate most of the manual operations heretofore requiring high operator skill and long experience. The manufacturer's extensive time and motion studies have produced a lathe capable of turning wheels at a rate which clearly spotlights the need of most shops for better, faster wheel-handling facilities.

The automatic functions of this lathe also remove another bottleneck in that after a short instruction period the average worker can become a qualified wheel lathe operator. A single lever on each carriage controls all tool slide movements. Enclosed templates provide safety motion limits in every direction as well as guided approach to the cutting position and guided retraction of the tools to starting position. Its simple and readily understandable calipering system eliminates guess-work and automatically sizes both wheels as well as avoiding any necessity for taping wheels before they come to the machine.

Wheel chucking is done with considerably less time and effort through the application of hydraulics and spring loaded centers to provide virtual "push button" chucking.

Carbide tooling costs and maintenance have been effectively dealt with through the use of identical size and shape carbide plugs in six of the turret tool holders which minimizes stocking problems and expense. A horsepower meter gives indication of tool wear and when dull, these carbide plugs have only to be reground flat on the top surface. No form grinding or gages are required to grind the set tool bits or tool holders in the lathe.

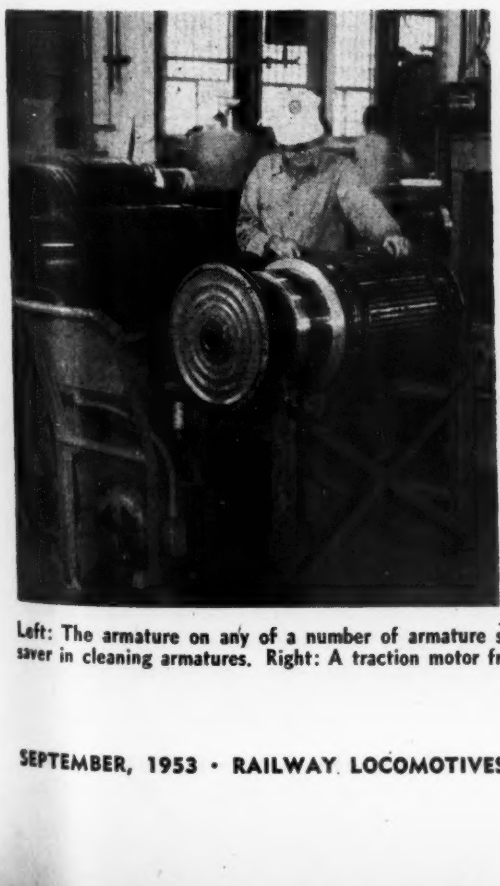
The machine is equipped with a complete set of readily interchangeable templates for all types of wheel contours, such as cylindrical, semi-cylindrical, standard A.A.R. taper, one wear and last turn of multiple wear wheels.

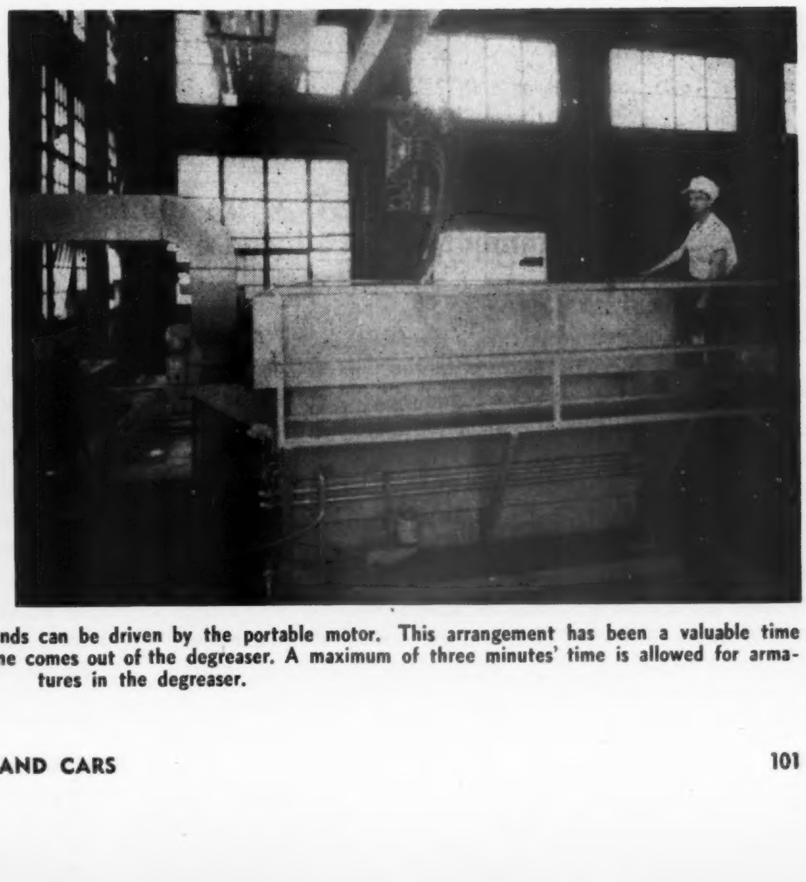
* Superintendent motive power, Great Northern, St. Paul, Minn.

ELECTRICAL SECTION

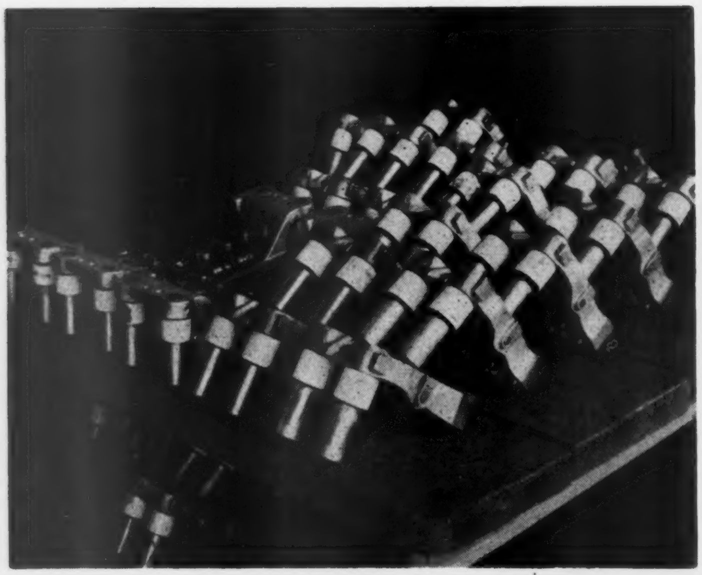
General view of the main section of the shop

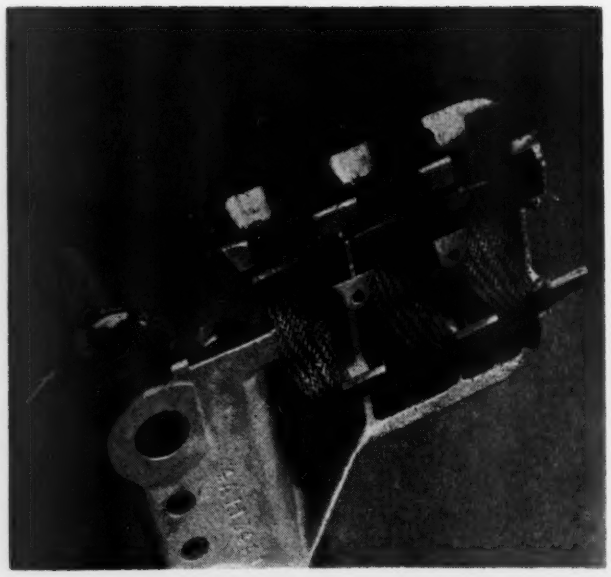
Seaboard Has Model Motor Shop at Jacksonville





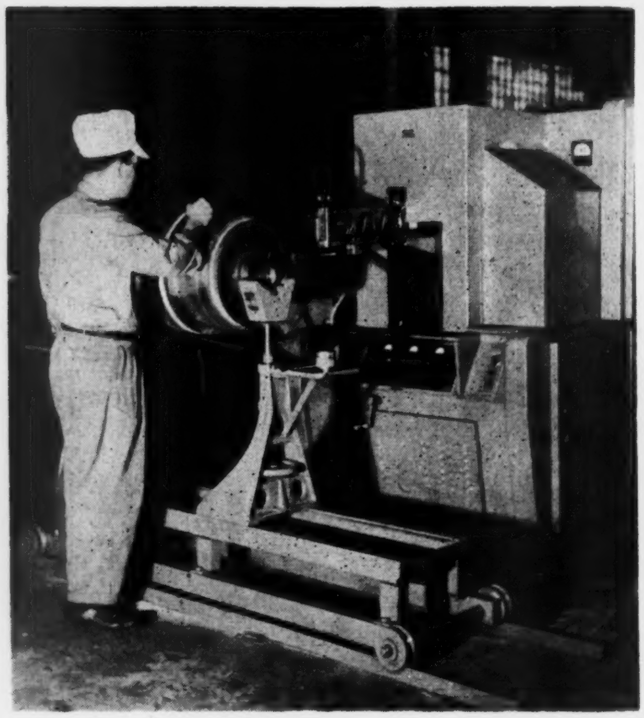
Left: The armature on any of a number of armature stands can be driven by the portable motor. This arrangement has been a valuable time saver in cleaning armatures. Right: A traction motor frame comes out of the degreaser. A maximum of three minutes' time is allowed for armatures in the degreaser.





Left, above: Brush rigging just out of the bright dip looks as if it were gold-plated. Right, above: Even the brush shunts come out of the dip completely clean.

After dipping, brush rigging is dressed up with crocus cloth.



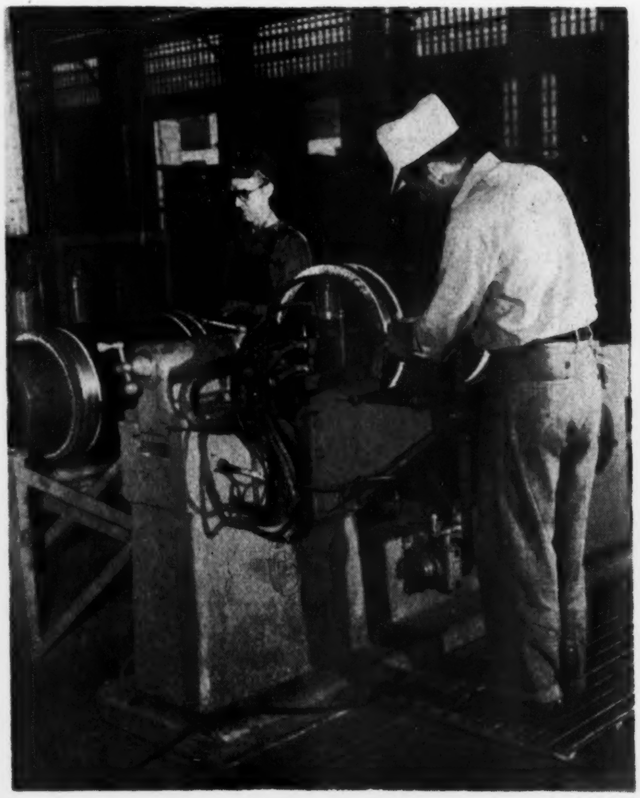
The high-frequency armature soldering machine.

Experience of six years abetted by a cooperative management has produced one of the country's best shops

WITH the experience gained in the past six years, the Seaboard Air Line has developed its diesel locomotive maintenance facilities at Jacksonville, Fla., to the point that the shop is exemplary both as to equipment and procedure. This is particularly true of the section of the shop devoted to the overhauling and rewinding of traction motors and generators and general electrical work for the railroad. In emergency cases, motors and generators are serviced in outside shops

The main section of the shop given over to motor and generator maintenance is 180 ft. long and 80 ft. wide. An additional low-bay space, measuring 100 ft. by 45 ft. is used for a balancing machine, two armature lathes, a banding machine, a high-frequency soldering machine and a corncob blast booth. There are also two adjoining rooms each 45 ft. by 35 ft. which are used respectively as a battery room and for housing an impregnator, baking ovens and a dipping tank. The reworking of control equipment is done in another shop.

As of March 1953 the Seaboard owned 2,142 traction motors, 2,016 of which were on locomotives and owned 594 generators, 569 of which were on locomotives.



Machine for brazing rear-end armature coil connections.

An armature core which has been cleaned by corn cob blasting.

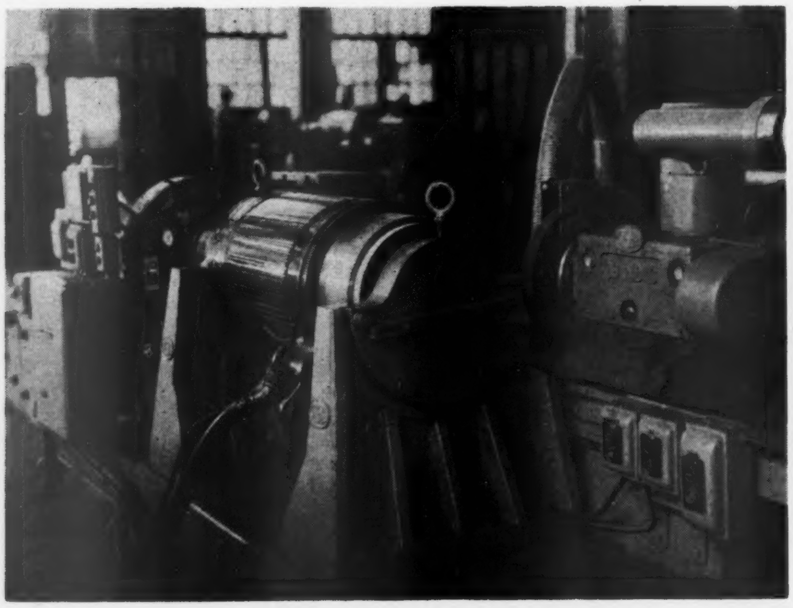
The arm of the high-frequency soldering machine which holds the heating loop close to the face of the risers is shown at the right.

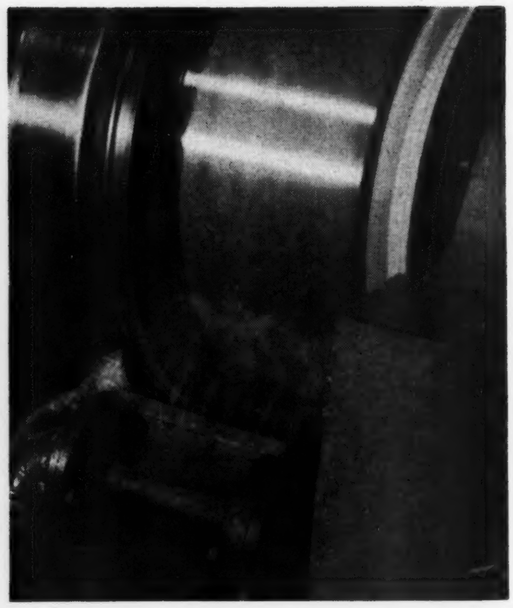
The heating loop when the high-frequency soldering machine is in service with smoke rising from the heated flux.

Procedures followed in the motor and generator shop are essentially similar to those used in other shops of comparable size, but differ in important detail. Incoming motors are first tested with a Megger insulation tester and if the insulation resistance justifies it, they are given a high-potential test. They are then disassembled without cleaning. Pinions are removed with an induction heater and bearings are pulled with a bearing puller. An induction heater will also be installed for bearings. The bearings when removed are cleaned and inspected and if in good condition, are reinstalled, being turned 90 deg. to their original position when this is done. All motor bearings are sealed grease lubricated, armature bearing housings are cleaned in a lye vat. Overhaul intervals are 250,000 miles for freight locomotives and 350,000 miles for passenger locomotives.

Frame Overhaul

Motor frames with coils in place are cleaned in a degreaser with trichlorethylene. After cleaning, the frames are sent to the frame section of the shop where they are given first an insulation-resistance test and then a high-potential test. These determine if light or heavy repairs are necessary.





Left: The commutator seasoning machine, showing the gas heating head at the left and the grinding wheel at the right. Right: An armature being spun in the seasoning machine, showing how the gas flame is applied to the commutator.

Light repairs include checking and if necessary replacing coil connections, retying leads, resleeving external traction motor leads and checking and cleaning connections. The coils are then given a Megger insulation test and are hi-potted at 1,050 volts for one minute. It has been the practice to spray the coils with insulation varnish, but as soon as a new and larger dipping tank is installed, the entire frame will be dipped in Sterling R-50 varnish. During this process, machine fits are protected with masking tape. The coils are finally Megger tested and given a high-potential test of 1,500 volts for one minute.

Armature Overhaul

Armatures are first degreased in trichlorethylene. They are left in the vapor for three minutes only and are then rinsed and removed. The armature then goes to the armature section of the shop where tests are made to determine the type of repair needed. Light repair is overhaul, heavy repair is rewind.

For light repair, the armature is first given a Megger insulation test and a high-potential test at 1,000 volts. If the tests are passed, bands and wedges are checked. Then excess varnish is removed from the surface of the armature and a strip on the outer portion of the commutator is cleaned to facilitate the making of a Ductor test. The machines on which this is done are armature stands on which the armature rests in ball bearings. A small motor with a V pulley and belt tightening arrangement mounted on a small truck is used for this purpose. The armature shaft is also fitted with a V pulley and the motor and armature pulleys are connected by a belt. This arrangement is shown in one of the illustrations. The armature is run at low speed, and a file is used to clean off excess varnish. Fine sandpaper is used to insure a clean surface for the Ductor tests. This machine which is shop made is one of the most effective time and hard work savers in the shop.

The armature is then heated in one of the ovens for 12 hours at 125 deg. C., after which it is impregnated in Sterling R-50 varnish for four hours. It is then baked at 140 deg. C. for 12 hours, dipped in Sterling R-50 varnish at atmospheric pressure and baked again for 12 hours at 140 deg. C.

It is then given Megger and hi-pot tests, the commutator is ground and the mica undercut if necessary. Finally the armature is balanced.

All brush rigging is cleaned and overhauled. Shunts are carefully checked and new insulators applied when necessary. All brush holders and brush studs are placed in a bright dip which removes all traces of oxidation, after which they are given a final touch-up with crocus cloth.

Finally the motors are reassembled, run light for four hours and given a high-potential test of 2,000 volts for one minute.

Heavy Armature Overhaul

When it is necessary to rewind an armature, a cut is made through the coils just back of the risers with a ¼-in. milling cutter. The end of each coil is then pried out and the coil is pulled out of the core slot with a come-along and an electric hoist. The core is cleaned with a corn cob blast. The coil ends are knocked out cold or are heated in a high-frequency soldering machine and knocked out.

Armatures are rewired with kits. Equalizers are insulated with mica strips between coils and core and between core layers. Silastic compound is used to fill the spaces between the coil ends back of the risers. In applying the main coils, Silastic paste is also used under the bottom main coils back of the risers.

The usual method of using temporary bands and metal sticks to pull the coils into the slots is used. Permanent bands are applied before the coil ends are soldered to the risers and before facing the oil ends. Back-end connections are brazed.

A high-frequency soldering machine is used for soldering coils ends to risers. For this operation the armature

(continued on page 111)

DIESEL-ELECTRICS—How to Keep 'Em Rolling

19 Control for Battery Charging

With a voltage regulator which works as its maker intended it should, a battery can live to a ripe old age

CHECK on yourself the next time you drive your car, especially in traffic. You'll find you are continually stepping on the gas, letting up on the gas, or touching the brake. You do these things almost automatically to control the car speed. In fact, you are the manual speed regulator for your car.

Suppose you tried to hold your car at exactly 40 miles per hour. On a straight, level, open road that would be easy. But in hilly country you would have quite a job. Going uphill your car would tend to slow down, and you'd have to feed more gas. On the level, it would tend to speed up, and you'd have to let up on the gas, on down grades, you might even have to use the brake. If you've ever tried to do this, you would know it requires constant attention.

The voltage regulator on a diesel-electric locomotive has much the same kind of a job. But instead of holding some exact speed, it holds the charging generator voltage at a constant value. On most locomotives, this is 74 volts. New let's see how this job is done.

Charging Generator

The charging generator is a small machine driven by the diesel engine, usually through gears or belts from the main generator shaft. There are three things that can change the voltage of the generator: (1) speed; (2) load; and (3) field strength. When the engine speeds up, the generator speeds up and its voltage rises. When the engine slows down, the generator slows down and its voltage drops. So, every time the throttle is moved, the generator voltage changes.

The generator charges the battery, Fig. 1. If the battery is run down, it will draw a high charging current and the generator load will be heavy. If the battery is fully charged, it will draw only a trickle of current and the generator load will be light. On most charging generators an increase in load pulls the voltage down, and a decrease in load lets it go up. So, whenever the generator load changes, the voltage also changes.

This is the nineteenth of a series of articles on the maintenance of diesel-electric equipment. This article is written by M. D. Henshaw and B. L. Judy, Locomotive and Car Equipment, General Electric Company, Erie, Pa.

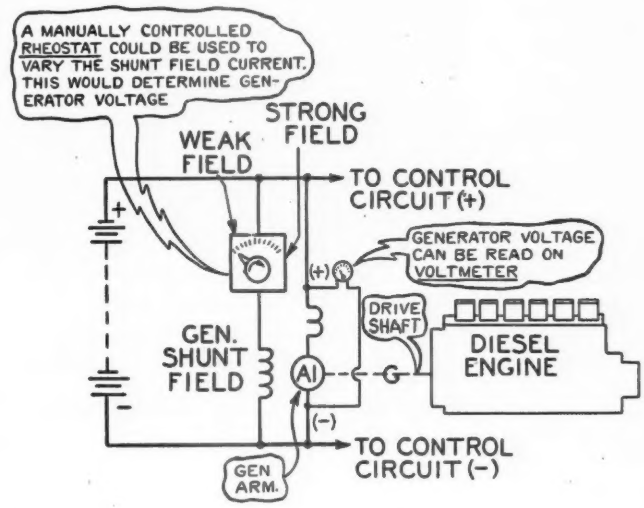


Fig. 1—Simplified battery charging circuits

Regulation

The rheostat in Fig. 1 controls the charging generator field current. Increasing this current will increase the generator voltage. Decreasing it will reduce the voltage. The generator field, then, gives us a means of controlling generator voltage. By changing it we can make up for changes in generator speed and load. When the engine is idling and the generator load is heavy, the field current must be high. When the engine is at full speed and the generator load is light, the field current must be low. To meet all operating conditions we have to be able to control the field current between these two extremes.

Voltage Regulators

Different locomotives use different means of controlling the charging generator voltage. On Alco-G.E. locomotives a voltage regulating relay, Fig. 2, is used to do the job. It consists of a field resistor, contacts to cut the resistance in and out, and a means of operating the contacts.

First let's look at the contact assembly, Fig. 3. It is made up of a set of movable fingers and a tapered contact bar. As the bar moves up it closes against the fingers one by one. As each finger touches the bar it cuts a step of resistance out of the generator field circuit. When the bar is all the way up all the fingers will be closed. As the

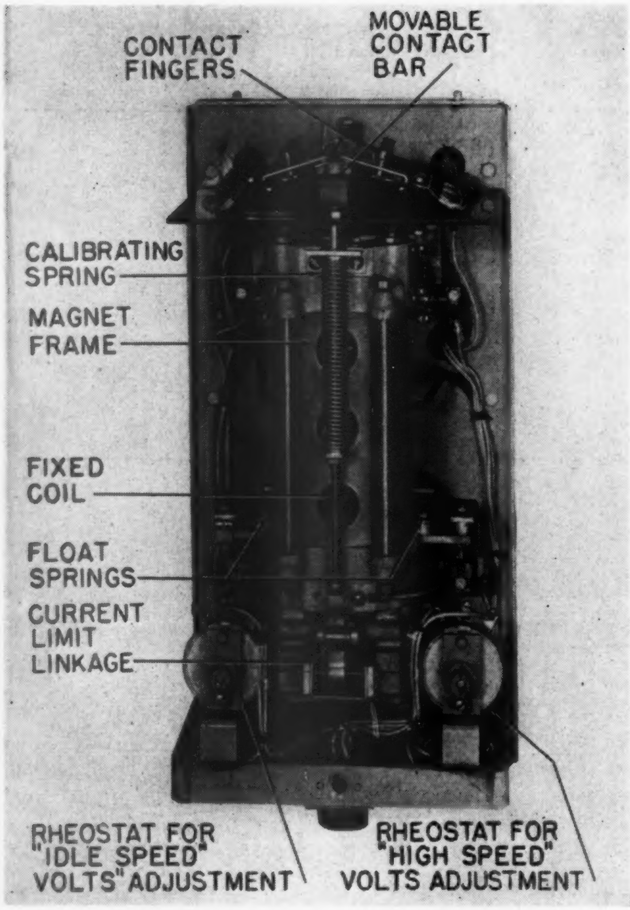


Fig. 2—Voltage control relay with cover removed so you can see the working parts

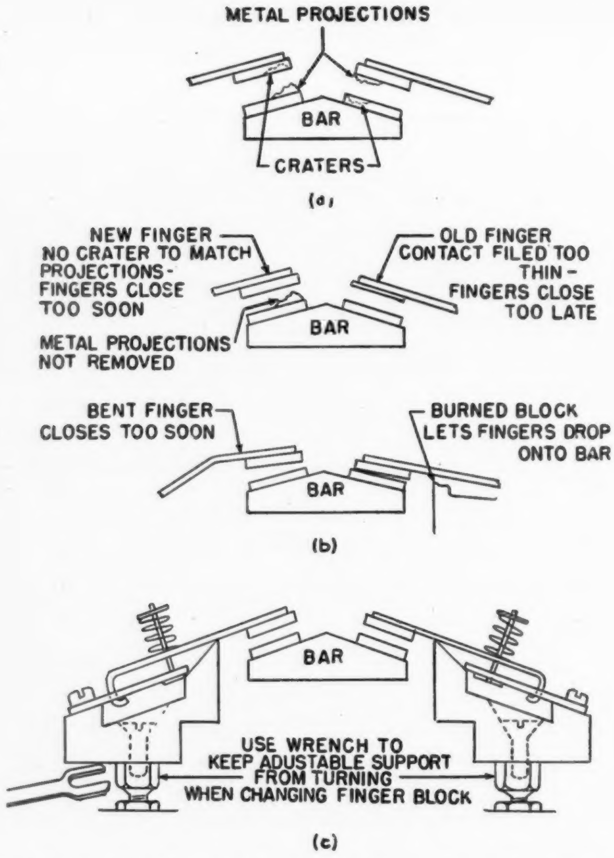
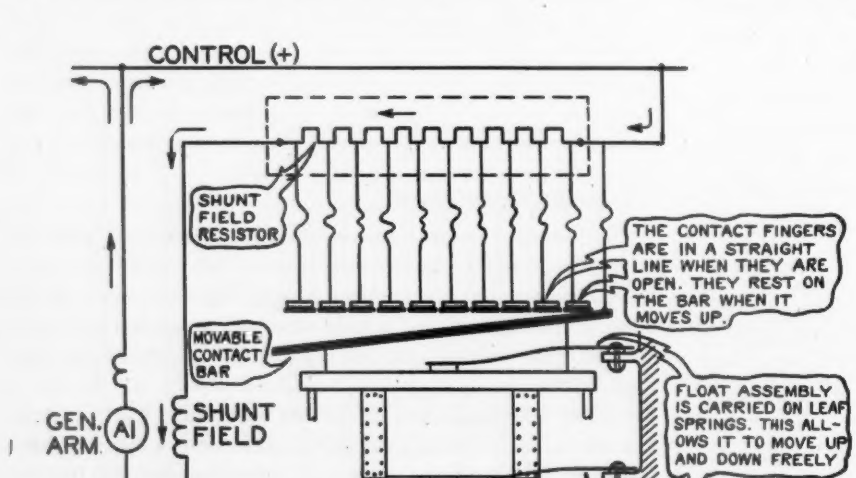


Fig. 4—Points that should be watched to insure proper operation of the relay contacts

bar moves down the fingers open one by one. As each finger opens it cuts a step of resistance into the generator field circuit. So the generator field current can be changed by moving the bar up and down. As you can see in Fig. 3b, the relay has two sets of fingers. This gives twice as many steps of resistance. By changing the resistance in small steps we get closer control of the charging generator voltage. We also get rid of the arcs that otherwise would soon burn up the fingers.

In normal operation the sparking is so small you can see it only by looking along the bar as the relay operates. But even this amount will cause some metal transfer between the contact surfaces. In time you will notice projections building up on some contacts and corresponding holes or craters opposite the projections. When they are big enough to see, Fig. 4(a), you should do something about them. If you let them go, you will soon get out of step contacts. This will cause bad arcing that will burn up the fingers, finger blocks and contact bar.

You can remove the contact bar and the rough fingers. Use a clean fine file to dress off the projections down to



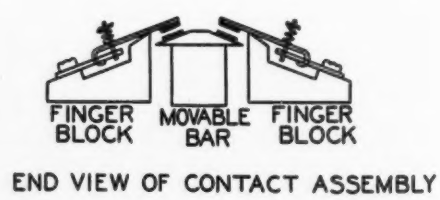


Fig. 3 a (left) and Fig. 3 b (above): Details of the contact assembly of the relay shown in Fig. 2.

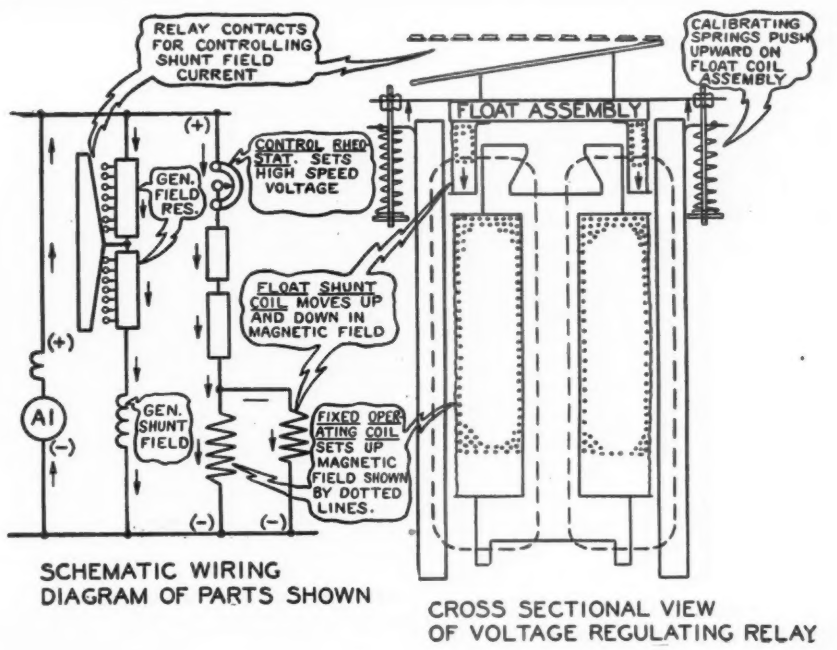


Fig. 5—The operating parts of the relay and how they are connected in the circuit

the original surface. Don't file below this or you will get contacts that come in late. And don't try to file out the holes. Let them go until they get as large as the contact buttons on the fingers. Then remove the finger or bar.

When you replace the bar, be sure the slope is right. The thin end should be toward the front. If you get it backward you'll have trouble, like a house with the roof sloping up instead of down. When you replace a finger, check the step by step operation by moving the bar slowly up and down.

To fix an out of step finger, look for metal projections that haven't been filed off, or contacts filed too thin, or bent fingers, or a burned finger block, Fig. 4(b). If you replace a finger block, keep a wrench on the adjustable supports as you remove or tighten the mounting screws, Fig. 4(c). This keeps the adjustment so the new block will be in the right position.

How It Operates

Let's see what moves the contact bar. Figure 5 is a cross section of the relay showing the contact assembly, and the parts that move it. When the relay is operating, there is a magnetic force trying to pull the float assembly down. At the same time the two calibrating springs are trying to push it up. So, there are two opposing forces trying to move the assembly.

Arrows on the diagram at the left of Fig. 5 show the direction of the currents that produce the magnetic forces. The relay has two coils—one fixed and one floating. They are connected across the charging generator so that they "see" generator voltage. If the voltage is low, current through the coils is low. If the voltage is high, current through the coils is high. The resistors and rheostat shown above the coils limit the current that can flow through the coils.

The force that operates this relay is produced a little differently than in other control equipment. In fact, this is more like a motor. Current flowing through the fixed coil sets up a magnetic field, shown by dotted lines, Fig. 5. It is like the one you get from the field coils in a motor. The float shunt coil is in this field. Current flowing through this coil produces a magnetic field. The action of these two fields results in a force, just as in the case of a motor. This force tries to pull the float coil down out of the magnetic field. The higher the float coil current, the greater will be the pull. Also, the higher the current in the fixed coil greater the pull will be. The calibrating springs act much like a grocer's scales and "weigh" the downward magnetic pull. The float assembly will come to rest at the point where the force of the

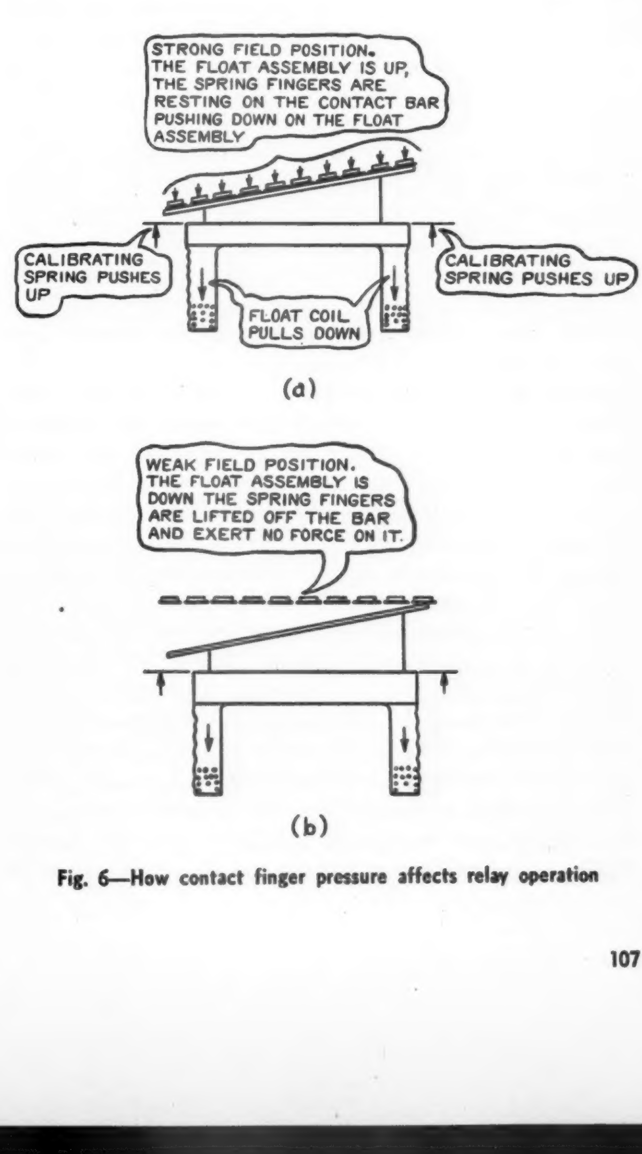


Fig. 6—How contact finger pressure affects relay operation

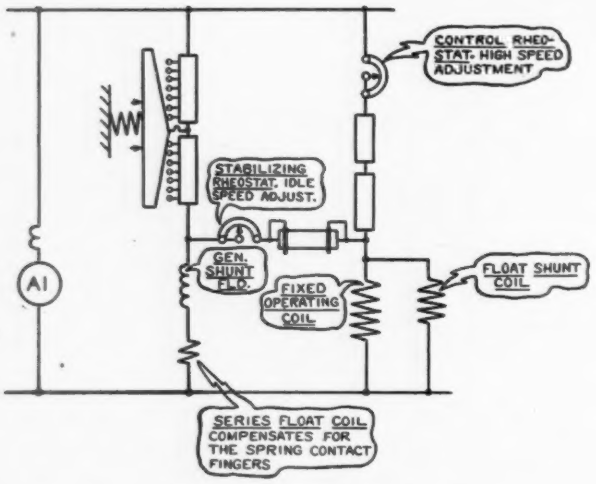


Fig. 7—Another relay coil in the generator field circuit compensates for finger pressure

springs and the pull of the float coil balance. The contact bar, carried on the float coil assembly, moves as the coil moves.

Voltage Control

New, let's see how the relay controls the charging generator voltage. When the voltage is low, the current through both the fixed and float coils will be low. This means that the downward pull will be low, and the springs will force the float assembly up. As the contact bar moves up, it will close some contact fingers and cut out generator field resistance. More current will then flow through the generator field and the generator voltage will increase. This causes more current to flow through the relay coils, and the downward pull on the float coil will be increased. As the contact bar moves down, the contacts will open and insert resistance in the generator field. This will reduce the field current and the generator voltage. Movement stops when the downward pull on the coil equals the upward push of the springs.

When the generator voltage is high, the current through the relay coils will be high. This will make the downward pull high, and the float assembly will move down. As the contact bar moves down, it will open the contact fingers and cut resistance into the generator field circuit. This will reduce the field current and the generator voltage.

Since the charging generator is driven by the diesel engine, its speed varies with engine speed. As the speed goes up the voltage will go up, as the speed goes down the voltage will go down.

Everytime you close a switch on the locomotive the charging generator load changes. Such changes also change the generator voltage. The greater the load the lower the voltage will go.

You might say that the charging generator voltage wants to play a game of follow the leader with the speed and load. It is the job of the voltage regulator to break this up. The generator voltage shows up across the fixed and float coils of the regulator. Any change in this voltage results in movement of the contact bar to adjust the generator field current. Thus the generator voltage is held steady even though the load and speed do change. Taking care of these changes keeps the float assembly

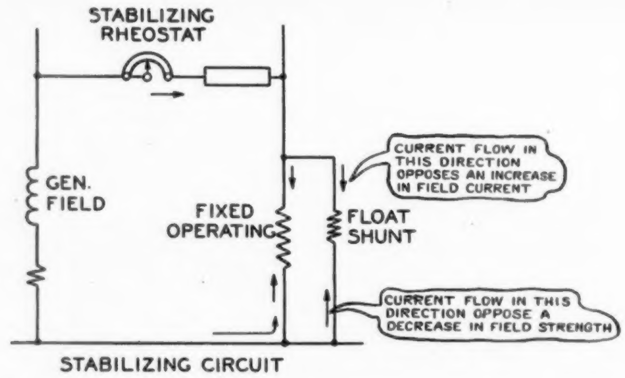


Fig. 8—The stabilizing rheostat keeps the relay from being jittery

on the move most of the time. You can see this if you watch the relay contacts when the engine is running.

Adjustments

You need some way to set the voltage the relay will hold. This could be done by changing the tension of the calibrating spring. Increasing the spring tension raises the setting, and decreasing it lowers the setting. This adjustment, however, should be made on a bench test set-up. Otherwise overheated or burned out relay coils may result. Another way to adjust the voltage setting is to change the resistance in series current with the relay coils by means of the control rheostat, Fig. 5. This is the adjustment you should use on the locomotive. Increasing the resistance of this rheostat raises the voltage setting, and decreasing it lowers the setting. This particular adjustment is most effective at high engine speeds. So the rheostat is usually called the high-speed rheostat. A little later we'll talk about a second rheostat that is used for low-speed adjustments. If the relay is cold, let it operate for half an hour or so until the coils warm up before making these adjustments. If you try to adjust a cold relay, the voltage will be too high when it warms up.

Refinements

In order to do a good job of holding voltage, we must compensate for the effect of contact finger pressure. The reason for this is easy to see. When the engine speed is low the float assembly will be all the way up, Fig. 6a. All of the contact fingers will be pressing on the bar. This pressure helps the downward pull of the float coil. As a result the field current will be too high. When the engine speed is high the float assembly will be all the way down, Fig. 6b. The contact fingers will all be open and there will be no pressure to help the pull of the float coil. As a result the field current will be too low. So, unless we compensate for finger pressure, the voltage will be too low at low speeds and too high at high speeds. To do this, we use another coil on the relay connected in the shunt field circuit of the generator, Fig. 7. It carries the shunt field current and is called the float series coil. It is wound on the same spool as the float shunt coil. But it is connected so that current flowing through it causes it to buck the float shunt coil. Let's see how this works out.

When the generator field current is high, the finger pressure helps the float shunt coil most and the series coil bucks it most. These two forces cancel each other.

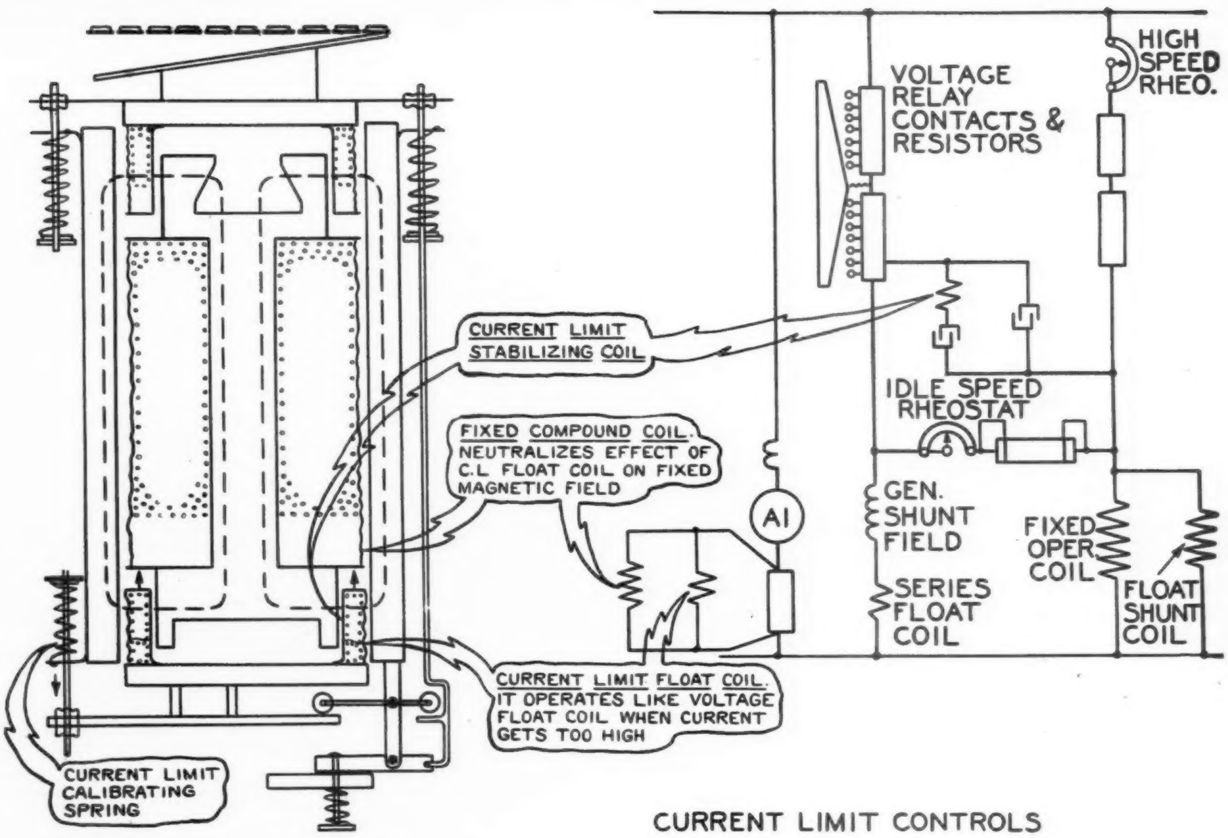


Fig. 9—The current limiting parts of the relay and how they are connected in the circuit

It's like adding $10 to your pay check and then deducting $10. When the field current is low, the finger pressure helps the float shunt coil very little and the series coil bucks very little. It's like adding $2 to your pay check and then deducting $2. In this way the series coil automatically cancels the effect of the fingers for every position of the float assembly. This means that the regulator will hold the same generator voltage regardless of the number of fingers that are closed.

Stabilizing

The actions we have talked about happen so fast that the relay would be jittery if nothing were done about it. This would make the charging generator voltage uneven. A dashpot might be used to steady the relay, but that would be complicated. It is simpler to use what amounts to an "electrical dashpot." This steadies the relay, but does not slow it down enough to notice. It is made up of the stabilizing rheostat and circuit shown in Fig. 8. The rheostat is connected from the top of the generator shunt field to the top of the fixed operating coil of the relay. This puts the float shunt and fixed operating coils in parallel with the generator shunt field.

This shunt field has considerable inductance, the effect of which is to keep current flow constant. For example, if a current of 10 amperes is flowing through the field, the inductance will try to keep it at 10 amperes, no more no less. If you ever opened a switch in the field current of a motor or generator, you noticed quite an arc. This shows that the current flow is hard to stop. On the other hand, if there is 2 amperes flowing in the field, the inductance will try to keep 2 amperes flowing. You might think of inductance as being like a flywheel. It takes a while to get a flywheel up to speed, but once it is up to speed it is hard to stop.

Now let's see how inductance is used to operate the stabilizing circuit of Fig. 8. Suppose the relay moves the contact bar up to allow more current to flow through the generator field. The inductance of the field resists this increase. So the current will momentarily flow through the stabilizing rheostat and the relay coils. Increased current in the coils will tend to pull the bar down and prevent too much field change. This effect lasts for only an instant until the current builds up in the field.

If the contact bar moves down, it will decrease the field current. The inductance of the field will try to keep the same current flowing. As a result current will flow up through the relay coils, and there will be a momentary decrease in the magnetic pull, tending to keep the bar from moving down. So the stabilizing circuit steadies the relay and keeps the voltage from going up and down every time the load or speed changes. The resistance of this circuit is such that you do not have to make any stabilizing adjustment.

The stabilizing rheostat has a second use. It forms a path for current to flow down through the regulating resistor to the relay coils. As Fig. 7 shows, this path will offer the least resistance when the relay contact bar is all the way up so that all of the regulating resistance is cut out This occurs at high field currents when the engine speed is low. By adjusting the stabilizing resistance then, you set the voltage at low speed. When you are adjusting the relay voltage, be sure always to make the high-speed setting first. Then make the low-speed setting and finally recheck the high-speed setting. Always be sure to have the relay cover in place when you do this.

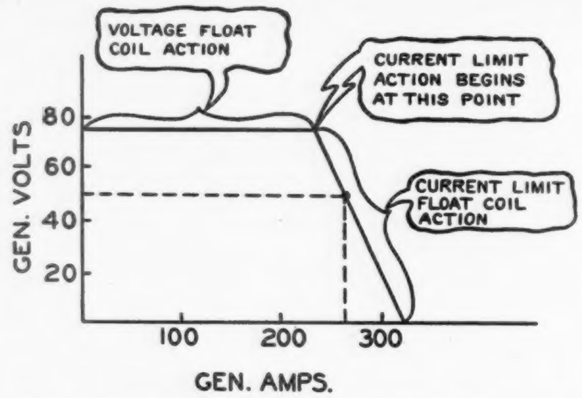


Fig. 10—How the relay regulates voltage and limits current

Current Limit

So far we have seen how the regulator holds a set voltage. But this is not its whole job. You've heard the saying, "where there's smoke there's fire." In an electric circuit this might be, "where there's voltage there's current." Current must flow through electric equipment to make it operate. But if there is too much current the equipment will be damaged. For instance, a dead battery offers very little resistance to current flow. Hence it would draw a very large charging current and overload the charging generator. We want to protect against this. If we were to use a circuit breaker or fuse it would open the circuit on overload. In this case, however, we simply want to hold the current to a safe value—not interrupt it. This can be done by reducing the voltage. A look at Fig. 9 will show you how the relay does this job.

A float coil assembly, much like the voltage float coil, is mounted on the lower end of the relay. Current flowing through the current limit coil causes it to be pulled up out of the magnetic field. This force acts against the current limit calibrating spring. The more current flowing the greater the pull will be. If the current is high enough, this pull will act through the linkage and help pull the float assembly down. This will reduce the field strength and, in turn, the generator voltage and current. So, by simply adding these few parts to the relay, we can limit the output current of the generator to a safe value. The stabilizing coil "steadies" the current limit float assembly and keeps it from acting on momentary current surges. The current limit it set by adjusting its calibrating spring.

In Fig. 10, you see a chart of the action of the voltage regulating relay. It shows how the generator voltage behaves as the load increases. Note that in this sketch the voltage stays at 74 regardless of the load current, up to about 240 amperes. When the current goes above 240

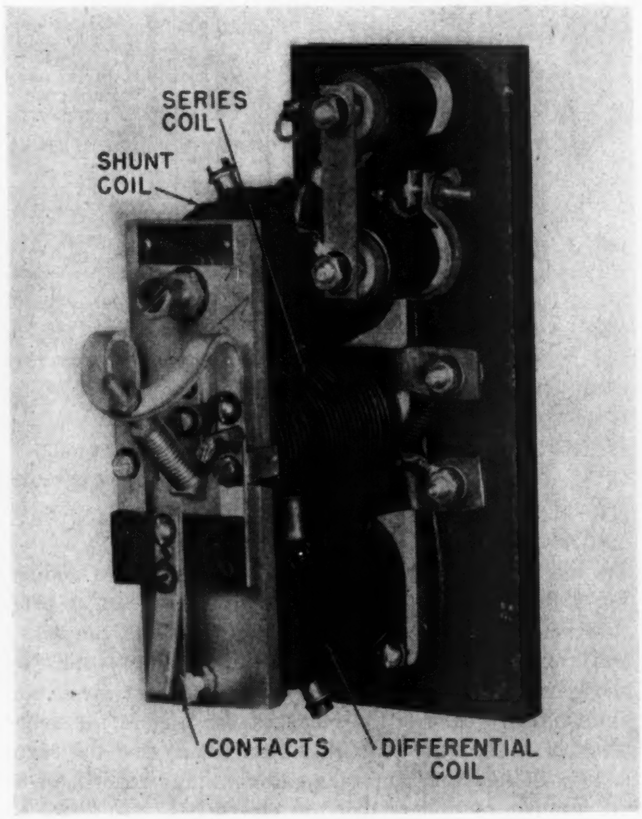


Fig. 11 (above)—One type of reverse current relay.

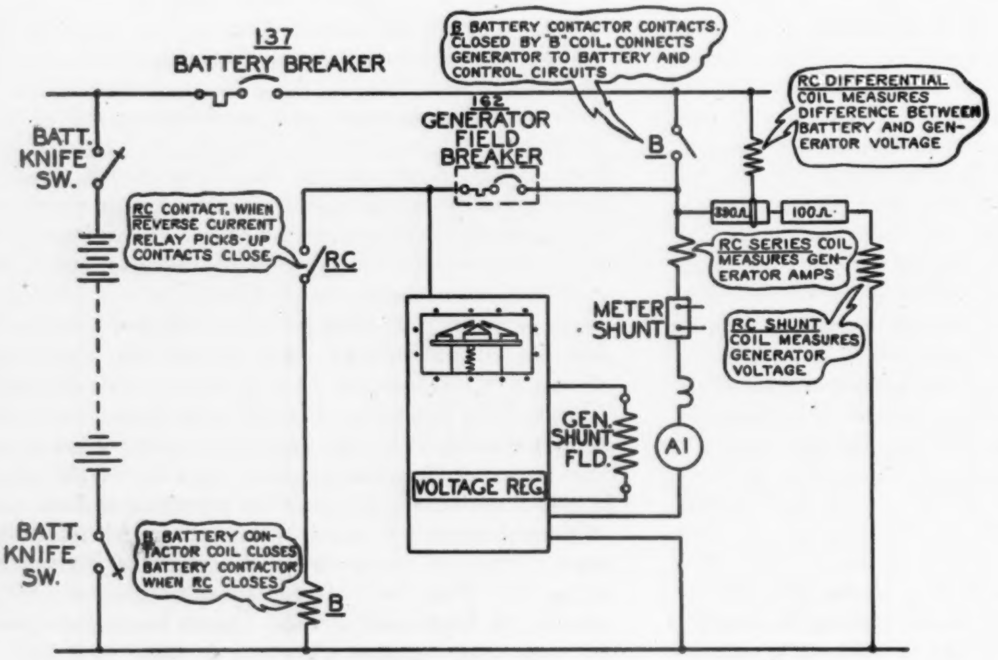


Fig. 12 (left)—Simplified diagram of battery charging circuits on Alco-G.E. Locomotive.

amperes, the current limit takes over and begins to reduce the generator voltage. This, in turn, reduces the current. For instance, look at the point marked on the current limit line. Here the load current is 270 amperes, and the voltage has been reduced to 50 volts. The current limit setting is not the same for all locomotives. Your instruction book will give you the correct value for your locomotives.

When the diesel engine is not running, the charging generator must be disconnected from the battery. If this is not done the battery will pump current through the generator and try to drive it as a motor. But since the generator is tied in to the engine, it cannot run as a motor. This is true anytime the generator voltage becomes less than the battery voltage. If it is not disconnected, the result will be a burned out generator and dead batteries. On Alco-G.E. locomotives a relay and contactor are used to give the needed protection. They automatically connect and disconnect the generator and the battery. The circuits are shown in Fig. 12. Let's see how they work.

The relay, Fig. 11, is called a reverse current relay and, as you can see, has three coils. The shunt coil is connected across the generator and measures generator voltage. The series coil is connected in series with the generator and measures generator load current. The differential coil, connected between the generator and the battery, measures the difference between these two voltages. These coils make up a three-man team. They work together so that the relay picks up when the generator voltage is higher than the battery voltage, and drops out when the generator voltage becomes less than the battery voltage.

A contact on the reverse current relay is connected in the circuit to the coil of the battery, contactor *B*, Fig. 11. This contactor does the actual work of connecting and disconnecting the battery. When the relay is picked up the contactor is closed. Then the generator is delivering charging current to the battery. This is the way it should be when the engine is running. When the relay is dropped out the contactor is open, and the generator is disconnected from the battery. This is the way it should be when the engine is shut down.

You've heard the old saying, "There's more than one way to skin a cat." The same thing is true of regulating charging generator voltage. There are different ways of doing it, but all aim at the same result. The Alco-G.E. scheme has been described in detail. You have learned what the job is and how it is done. The scheme used in your locomotives may be different. However, if you understand one, the others will come easy.

Seaboard Has Model Motor Shop at Jacksonville

(continued from page 104)

is placed in the machine. A paste consisting of a mixture of soldering flux and 95 per cent tin—5 per cent antimony solder—is applied to the face and rim of the armature risers. A space of about 3/8 in. of the face of the riser next to the commutator does not receive paste and similarly a space of 1/4 in. without paste is left at the coil end of the rim of the risers. When high-frequency current is applied a small copper loop close to the risers causes four or five risers to be heated by inducing eddy currents in them. As soon as the first group of risers is up to soldering heat, a motor drive is started which causes the armature to rotate slowly. Soldering is then automatic and is complete when the armature has made one turn.

Top fillers in risers are not used and there is no string band behind the risers. The armature is impregnated and baked as in the case of mileage overhaul. The commutator surface is ground and undercut and the string bands are painted with Flintflex. It receives a final one-minute, high-potential test at 2,500 volts.

The seasoning machine is used whenever it becomes necessary to tighten or otherwise disturb a commutator. A loose commutator is detected by tapping it with a light hammer. During the process of seasoning, heat is applied to the commutator by means of a gas flame and heating and cooling are automatically controlled.

The following is a list of the principle pieces of equipment used in the shop.

1 Westinghouse high-frequency soldering machine
1 General Electric surge comparison tester (not yet in service)
1 Shop-made armature cleaner
1 American Electric Fission Corp. brazing machine for back armature connections
24 Armature stands
1 banding machine
1 Electric Service Manufacturing Co. armature machine
1 General Electric armature seasoning machine
1 Lodge and Shipley 24-in. lathe
1 Gisholt Dynetric balancing machine
1 Farquhar 600-ton hydraulic press
1 Dipping tank large enough for generator frames
1 Armature cooler with ILG 1¼-hp. blower
2 Young Brothers Company electric ovens (a third to be installed)
1 Booth for corn cob blasting (8 ft. by 10 ft.)
1 Detrex degreaser

Battery-powered unit which pulls and pushes diesel units around the New York Central shop at Niles, Mich. It is powered by a 32-cell, 600-amp.-hr. battery furnishing current to two motors, and operated by one man who guides it by keeping his finger on the control button as he walks beside it

Questions and Answers

Interchange Rules

This is the first installment of a new series of questions and answers on the Association of American Railroads Code of Rules Governing the Condition of, and Repairs to, Freight and Passenger Cars for the Interchange of Traffic which may help car men clarify their understanding of the philosophy, intent and requirement of the Interchange Rules. The answers given to the questions are not to be considered interpretations of the rules of interchange, which can only be rendered by the Arbitration Committee acting officially. The comments, however, will come from a background of intimate association with the application of the rules. Obviously, comments or opinions as of today, may be inapplicable after a revision of the rules or further interpretations by the Arbitration Committee.—Editor

1-Q.—When a car is received in interchange with a section of metal running board missing, is the repairing road justified in demanding a defect card from the delivering line for such missing material?

A.—Missing section of metal running board is not cardable in interchange. However, when the receiving road does not have a section of metal running board in stock to make proper repairs, a wooden section of running board may be applied, charge for such work to be billed versus car owner and defect card issued for labor only.

2-Q.—In renewing a hanger-type brake beam in a truck not having brake beam safety supports but with truck sides equipped with safety ledges, would it be proper for such beam to be 66 in. in length overall?

A.—No. In the event of subsequent hanger or pin failure at this location, such beam might drop to the rail. Note 2 following Par. (b-8) Rule 3 requires that brake beams in such cases must have an overall length of not less than 66¾ in.

3-Q.—When the heater box of a refrigerator car is located about 12 in. inside the side sill and this box becomes broken on account of being struck by some object, would such damage be cardable in interchange?

A.—No; such defects are owner's responsibility.

4-Q.—Why is it to the advantage of a railroad to keep its repair points adequately stocked with all sizes of secondhand cast iron, one-wear and multiple-wear wheels at all times for use on foreign cars in case of handling line responsibility?

A.—To avoid losses which would be incurred where it became necessary to use new wheels in such cases.

5-Q.—How many types of air hose gaskets have been approved for use on cars?

A.—An A.A.R. Standard and an A.A.R. Alternate Standard have been approved. See A.A.R. Specification M-602-51 in the A.A.R. Manual.

6-Q.—In preparing plans and specifications for new flat cars to be built or rebuilt after January 1, 1954, what new requirement must be considered?

A.—Such cars should then be equipped with lading strap anchors as shown on A.A.R. Manual page C-26A, or an equivalent arrangement.

7-Q.—When the fixed end of a steel gondola car is bent out beyond proper clearance and a section of such steel end is cut out and boarded over to establish proper clearances, does this constitute a delivering line defect for which defect card should be demanded in interchange?

A.—Yes. Such damage is cardable under the provisions of Sec. (6) Rule 32.

8-Q.—Are the wear limits specified in Rule 24 intended for use in condemning truck side frames under foreign cars?

A.—No.

9-Q.—When the journal wedge and top of journal box are damaged by journal contact in connection with a hot box, is the handling road responsible?

A.—Yes.

10-Q.—When special protective coatings or rubber linings are applied to the insides of tank-car tanks, or special protective coatings are applied inside covered hopper cars, what action must be taken by car owners to protect themselves against subsequent damage which might be caused by going inside such cars in connection with steaming, cleaning, inspection or repairs?

A.—Car owners must stencil such cars to indicate kind of protective coatings and date of application.

11-Q.Are the condemning limits specified for journal bearings under Sec. (j) Rule 66 intended to apply only in connection with periodic repacking of journal boxes, or do they apply in connection with wheel changes and individual applications of journal bearings?

A.—Condemning limits specified apply in all cases.

12-Q.—In changing wheels, is it proper to apply secondhand or secondhand rebroached journal bearings?

A.—New journal bearings should be applied.

13-Q.—Is it proper to use the 1934 design steel wheel gage shown on page 168 of the 1953 Code of Interchange Rules for determining the condemning limit for flange height on all wrought steel wheels?

A.—Steel wheel gages of 1934 design now in service may be used until they are worn out or damaged and they should be replaced with the 1953 design steel wheel gage shown on page 169 of the 1953 Code.

14-Q.—When one pair of cast iron wheels in a truck with integral-type side frames is changed, what disposition should be made of the other two journal bearings of the other pair of wheels in the same truck?

A.—These other two journal bearings in the same truck should be examined closely and if found in serviceable condition they should be cleaned, oiled and replaced on the same journals. However, in cases where defects as outlined in Sec. (j) Rule 66 are found, new journal bearings should be applied.

15-Q.—When a pair of cast iron wheels is removed on account of one wheel having a worn flange and the mate wheel has two brake burn cracks, each measuring 1¾-in. across the tread, and two comboy spots, each consisting of a continuous cavity 1 in. in length, how should such mate wheel be classified on billing card?

A.—Such mate wheel should be classified as scrap.

Diesel-Electric Locomotives*

RADIATORS (Continued)

843-Q.—What operation should follow?
A.—Apply lift rigging and remove block assembly from base. Remove free end casing.

844-Q.—What is recommended for inspection?
A.—Clean and inspect (by magnaflux process if available) all saddles of the block. Paint interior of block with Red Sealer #50031 or its equivalent.

845-Q.—What operation is necessary in connection with the flanges to be mated?
A.—It is necessary to inspect, clean, and remove burrs from flanges to be mated and to apply a thin coating of joint sealer similar to Tight Seal #4 on the base flange.

846-Q.—What method should be used to attach the block to the base?
A.—Apply two tapered and tapered pins to one side of the block. These are used as guides when lowering the block on the base. Set block on base and remove guide pin.

847-Q.—What is the procedure if an engine block is to be re-applied to the same base?
A.—The locating dowels driven into the flange of the base will position the block accurately. Apply and tighten all capscrews; wire interior capscrews.

848-Q.—If a block and base not previously mated are to be joined, what should be done?
A.—Apply and snug up the first two capscrews on each corner of the base at the generator end.

849-Q.—What operation should follow?
A.—Measure the block overhang with a depth micrometer at the right corner, generator end, and shift the block sideways with aligning jack so as to have the block overhang the base by .125 in.

850-Q.—What action should follow?
A.—Shift the block forward or backward until the vertical end faces of the block and base are flush at the generator end. Check with a dial indicator.

851-Q.—What should be the overhang at the right corner, free end?
A.—Block should overhang base by .122-.128 in.

852-Q.—What finally should be done?
A.—Apply and tighten all block to base capscrews. Drill and ream dowel holes and apply dowels; wire interior capscrews.

853-Q.—How many journals and crank pins situated on the crankshaft?
A.—The twelve-cylinder engine has six crank pins and seven main journals. The sixteen-cylinder engine has eight and nine respectively.

854-Q.—How are the connecting rods positioned?
A.—Two connecting rods, right and left bank of the same cylinder number, are mounted side by side on each crank pin.

855-Q.—How is the crankshaft horizontal thrust taken care of?
A.—The crankshaft horizontal thrust is carried by one main thrust bearing situated at the main generator flange end of the shaft.

856-Q.—What is the function of the split gear situated between the thrust bearing and the main generator flange?
A.—To drive the camshaft gearing.

857-Q.—What is the purpose of the extension shaft mounted on the free end of the crankshaft?
A.—Provides a drive for the cooling water and lubricating oil pump and a mounting for a viscous type vibration damper.

858-Q.—How is the crankshaft positioned?
A.—The shaft is underslung on the block, all bearings are of the lead overlay type with a bronze base metal suitably strengthened by a steel back.

859-Q.—How is end leakage prevented?
A.—Oil slingers and catchers are provided at both ends of the shaft for this purpose.

860-Q.—What is the procedure when removing crankshaft and extension shaft?
A.—They are removed with the cylinder block in the inverted position.

861-Q.—What precaution must be taken?
A.—DO NOT REST BLOCK ON CYLINDER HEAD STUDS. The block can be placed on suitable wooden blocks or positioned by engine turning plates bolted to its ends.

862-Q.—How are the main bearing caps removed?
A.—Remove the castellated nuts, tap the main bearing caps loose from their saddles with a soft hammer and remove the caps with bearing shells in place.

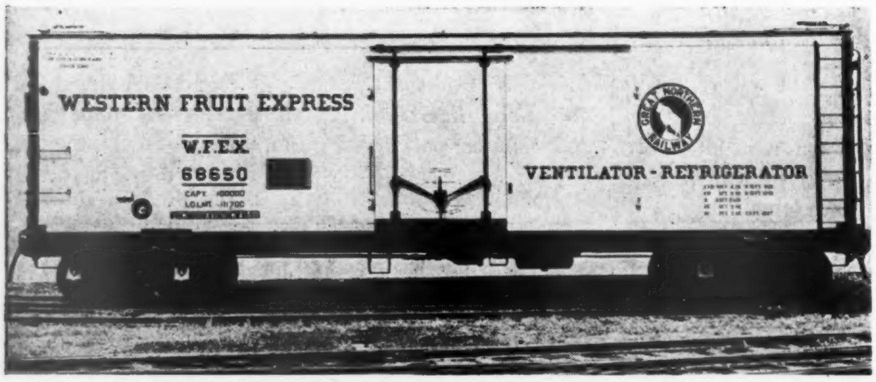
863-Q.—How is the crankshaft removed?
A.—Suitable slings with lifting block assembly are attached to two crank pins. The crankshaft is then lifted carefully from the saddle bearings about 1/16 in. so that the saddle half of the thrust bearing can be rolled out.

864-Q.—What action should be taken to prevent damage to saddle bearing shells?
A.—Be sure that saddle bearing shells do not adhere to the main journals when removing the crankshaft. Damage to the bearings will result if they fall from the shaft.

865-Q.—How is the operation completed?
A.—Rest crankshaft on wooden horses, remove main bearing shells from cylinder block saddles and main bearing caps.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives. The figure numbers and references, by number, to diagrams, etc., relate to the current edition of the Alco-G.E. operating and maintenance manual.

NEW DEVICES



Refrigerator Car Doors

The sliding flush door for refrigerator cars is the latest development of The Youngstown Steel Door Company, Cleveland 14, Ohio. They are said to permit movement of large unit loads which cannot be handled in cars with swinging doors.

A more effective seal, accessibility, greater resistance to transfer of heat, elimination of shrinkage, warpage, reduction of weight, ease of operation and elimination of time consumed in spotting cars at loading platforms are some of its characteristics.

Wider door openings speed loading and unloading and give the cars an availability for lift trucks and palletized loading. These wider door openings also serve to minimize damage to door posts.

The manufacturer can supply the units complete and ready for hanging.

■ ■ ■

Glass Fiber Pipe Insulation

A one-piece fine glass fiber pipe insulation, known as G-B Ultrafine, has been announced by the Gustin-Bacon Manufacturing Company, Kansas City 5, Mo.

According to the manufacturer, the formulation has a high thermal efficiency. The K factor is much lower than that of any conventional pipe covering. It is light in weight with claims for 4 to 10 times lighter than any other. The insulation can quickly spread at the seam to snap over pipe. It will not break, powder, crumble, soften in contact with water, bend out of shape or deteriorate in transit, storage, or on the job. The product can be easily cut with an ordinary knife, it can be painted for sake of appearance.

This pipe insulation is composed of fine glass fibers bonded with a phenolic resin and molded into one-piece sections of 6-ft. lengths. It resists the attack of most acids and alkalies and is not corrosive to metals. It is said to be suitable for all heating applications up to 350 deg. F. to cover pipes of 2 to 10 in. diameters.

■

Gearless Angle Grinder

An air-powered direct drive angle grinder, the size 2FA-60, has been introduced for surface grinding, cut-off and sanding jobs. Speed of the unit at 90 lb. per sq. in. pressure is 6,000 r.p.m. It is manufactured by the Ingersoll-Rand Company, New York 4.

Two types of dead handles are available, one is straight and the other is 30 deg. off straight. Handles may be attached to either side of the unit, and the angle dead handle may be rotated to any of four positions.

Lubrication is provided by a built-in lubricator and heavy duty ball bearings reduce friction. The motor is muffled to reduce noise and its exhaust deflector is adjustable to deflect exhaust gases away from its operator.

■

Rectifier Welder

Metal and Thermit Corporation, 100 East 42nd street, New York 17, announces the availability of a new d.c. rectifier welder in 200, 300 and 400 amp. ratings. This machine is a heavy duty unit built for day in and day out service in production welding. Its design incorporates fanforced, up-draft ventilation which provides low operating temperatures and assures long rectifier life.

■

Noise Detector Sees and Hears

The Anco Instrument Division, 4254 W. Arthington street, Chicago, has introduced a new audio-video model of the Elec-Detec, portable electronic instrument designed for locating, amplifying and measuring noise sources in all types of mechanical

(Continued on page 128)

NEWS

Interstate Commerce Commission

W. J. Patterson

Interstate Commerce Commissioner William J. Patterson retired July 10, rounding out a career with the commission which began in 1914. As staff member and later as commissioner, Mr. Patterson served longer with the I.C.C. than any previous member of the commission.

Mr. Patterson's latest term as commissioner expired December 31, 1952, but he continued to serve until his successor, Owen F. Clarke, was appointed and approved.

Owen F. Clarke

Mr. Clarke, who is a former chairman of the Washington Public Service Commission, has been assigned to the I.C.C.'s Division 3, with administrative supervision over the Bureaus of Safety and Locomotive Inspection.

Owen F. Clarke

Charles H. Grossman

Mr. Grossman of Albuquerque, N.M., has been nominated to head the Bureau of Locomotive Inspection of the Interstate Commerce Commission.

Mr. Grossman has been with the bureau since April 4, 1918, and is its senior inspector in length of service. He is a member of the Brotherhood of Locomotive Firemen & Enginemen.

The bureau directorship is a Presidential appointment, subject to confirmation by the Senate. Mr. Grossman's name was sent to the Senate July 31, shortly before adjournment, and no hearing was scheduled.

Mr. Grossman, who is 62, would succeed Edward H. Davidson as director of the bureau. Mr. Davidson retired September 30, 1952, upon reaching the age of 70.

Allyn C. Breed, one of the two assistant directors of the bureau, has served as acting director since Mr. Davidson's retirement. Mr. Breed, 71, is exempt from the usual retirement-at-70 rule because he comes under provisions of an Executive Order exemption granted in 1942 by President Roosevelt.

Use of Rear Journal Box Seals Approved

On recommendation of the Committee on Lubrication of Cars and Locomotives, the

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE AUGUST ISSUE

Diesel-Electric Locomotive Orders

Road	No. of Units	Horse-Power	Service	Builder
Duluth, South Shore & Atlantic	1	1,600	Road switch	Baldwin-Lima-Hamilton

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Chicago, Rock Island & Pacific	25[1]	Airslide covered hoppers	General American
Kansas City Southern	200	50-ton flat	American Car & Fdry.
Minneapolis & St. Louis	17[2]	Airslide covered hoppers	General American
Seaboard Air Line	400[3]	Covered hopper	American Car & Fdry.
	300	Wood rack	Bethlehem Steel
Texas Mexican	20[4]	70-ton gondola	Pullman-Standard
Western Pacific	200[5]	70-ton gondola	Pullman-Standard

Freight-Car Inquiries

Pennsylvania	100–300	70-ton covered hopper	

Passenger-Car Orders

Road	No. of cars	Type of car	Builder
Baltimore & Ohio	3[6]	RDC-1	Budd Co.
	2[6]	RDC-2	Budd Co.
Chicago, Milwaukee, St. Paul & Pacific	2[7]	Sleeping	Pullman-Standard
Chicago, Rock Island & Pacific	12[8]	Sleeping	Pullman-Standard

[1] Delivery scheduled for about the beginning of 1954.

[2] Delivery scheduled for October or November.

[3] Covered hoppers scheduled for delivery during first quarter of 1954; the wood rack cars, for delivery during the fourth quarter of 1953.

[4] Estimated cost, $145,000. Delivery scheduled for second quarter of 1954.

[5] Estimated cost, $7,850 each. For delivery during the first quarter of 1954. According to the president, Frederick B. Whitman, the WP is contemplating the purchase of perhaps as many as 900 gondola cars over the next four years. The road is also thinking about additional box cars, he said.

[6] The cars were scheduled for delivery during August.

[7] For delivery during the third quarter of 1954. Each car will have four bedrooms, six romettes, and eight duplex roomettes.

[8] Estimated cost, $2,200,000. Delivery scheduled for September, 1954.

Notes: *Louisville & Nashville.*—The L&N is converting three sleeper-lounge cars into tavern-loung cars for service on its "Pan American." The conversion will cost about $213,580.

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes: System	Foreign	total	Miles per hot box car set off between division terminals
July, 1950???	2,745,932,894	....	....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,809,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952	2,924,917,122	11,658	17,535	29,193	100,192
September, 1952	2,931,129,734	7,536	13,608	21,144	138,627
October, 1952	3,093,990,289	4,058	8,053	12,111	255,469
November, 1952	2,984,101,808	2,198	4,501	6,699	445,455
December, 1952	2,869,928,617	1,742	3,632	5,374	534,040
January, 1953	2,828,906,282	2,219	4,123	6,342	446,059
February, 1953	2,625,563,462	2,111	4,059	6,170	425,537
March, 1953	2,904,227,804	2,696	6,077	8,769	331,192
April, 1953	2,850,752,648	3,383	6,435	9,818	290,359
May, 1952	3,013,610,843	5,892	11,433	17,325	173,945

Mechanical Division, A.A.R., has authorized the use on cars in general interchange service of 1,000 car sets of the rear or dust-guard journal-box seal of Journal Box Seals, Inc., Los Angeles, Cal. All concerned are requested to report installations, as well as performance data, to the secretary of the Division from time to time.

R. G. May Succeeds Aydelott

RICHARD G. MAY, assistant vice-president of operations and maintenance of the New York Central, has been elected vice-president in charge of the Operations and Maintenance Department of the Association of American Railroads.

Richard G. May

Mr. May, who is 49, succeeds James H. Aydelott, who retired on August 31 after 51 years of railroad service.

Shop Additions And Improvements

Great Northern.—A contract has been awarded for construction of an addition to the Great Northern's freight car shops at Waite Park, near St. Cloud, Minn. "Expanding use of steel cars in freight service" was cited as the reason for building the added facilities.

The addition will be an entirely new building 200 ft. by 305 ft., with a connected addition 54 ft. by 110 ft. It will be used for assembling steel parts for new freight cars being built at Waite Park. Construction will require about a year to complete.

The main structure will have a maximum height of 48 ft., including crane bays. It will be single-story, of brick, steel and glass block construction. The smaller addition will have two stories and will house lunch and locker rooms, offices, conference quarters and tool storage space. Heating will be by steam with mechanically operated equipment for both heating and ventilation.

Union Pacific.—A locomotive cleaning and paint stripping rack is being built at the Omaha shop yard ($42,000). Additional facilities for rebuilding diesel locomotive engines are being provided in existing shops there. Four additional drop pit tables will be installed and two will be relocated, an overhead crane will be installed, and the area will be completely air conditioned ($175,000). Glass block walls will be built around the area in connection with this work.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of April 1953	Month of April 1952	4 months ended with April 1953	4 months ended with April 1952
3	Road locomotive miles (000) (M-211):				
3–05	Total, steam	12,132	16,811	50,094	75,533
3–06	Total, Diesel-electric	30,703	26,531	120,216	104,695
3–07	Total, electric	742	771	2,957	3,170
3–04	Total, locomotive-miles	43,634	44,130	173,504	183,435
4	Car-miles (000,000) (M-211):				
4–03	Loaded, total	1,653	1,592	6,523	6,598
4–06	Empty, total	901	880	3,524	3,560
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):	22,048	29,751	88,176	135,653
6–01	Total in coal-burning steam locomotive trains	5,665	7,959	22,863	33,306
6–02	Total in oil-burning steam locomotive trains	85,979	73,662	334,636	289,660
6–03	Total in Diesel-electric locomotive trains	2,135	2,151	8,297	8,797
6–04	Total in electric locomotive trains	116,032	113,601	454,800	467,591
6–06	Total in all trains				
10	Averages per train-mile (excluding light trains) (M-211):	1.03	1.03	1.03	1.04
10–01	Locomotive-miles (principal and helper	41.00	39.40	40.80	39.60
10–02	Loaded freight car-miles	22.40	21.80	22.00	21.30
10–03	Empty freight car-miles	63.40	61.20	62.80	60.90
10–04	Total freight car-miles (excluding caboose)	2,880	2,814	2,842	2,802
10–05	Gross ton-miles (excluding locomotive and tender)	1,305	1,292	1,283	1,300
10–06	Net ton-miles	31.80	32.80	31.50	32.90
12	Net ton-miles per locaded car-mile (M-211)				
13	Car-mile ratios (M-211):	64.70	64.40	64.90	65.00
13–03	Per cent loaded of total freight car-miles				
14	Averages per train hour (M-211):	18.30	17.70	18.30	17.50
14–01	Train miles	52,191	49,276	51,537	48,404
14–02	Gross ton-miles (excluding locomotive and tender)				
14	Car-miles per freight car day (M-240):	45.90	44.50	45.00	45.10
14–01	Serviceable	43.80	42.30	42.90	43.00
14–02	All	901	893	877	919
15	Average net ton-miles per freight car-day (M-240)				
17	Per cent of home cars of total freight cars on the line (M-240)	47.00	44.30	47.20	42.00

PASSENGER SERVICE (DATA FROM I. C. C. M-213)

Item No.		Month of April 1953	Month of April 1952	4 months ended with April 1953	4 months ended with April 1952
3	Road motive-power miles (000):				
3–05	Steam	4,432	7,015	18,954	30,817
3–06	Diesel-electric	19,895	18,061	78,856	71,724
3–07	Electric	1,553	1,625	6,277	6,598
3–04	Total	25,880	26,700	104,087	109,146
4	Passenger-train car-miles (000):				
4–08	Total in all locomotive-propelled trains	260,188	265,740	1,046,498	1,080,717
4–09	Total in coal-burning steam locomotive trains	26,979	37,497	108,944	163,983
4–10	Total in oil-burning steam locomotive trains	12,865	24,557	58,874	102,390
4–11	Total in Diesel-electric locomotive trains	202,785	185,483	808,084	740,719
12	Total car-miles per train-miles	9.74	9.74	9.76	9.72

YARD SERVICE (DATA FROM I.C.C. M-215)

Item No.		Month of April 1953	Month of April 1952	4 months ended with April 1953	4 months ended with April 1952
1	Freight yard switching locomotive-hours (000):				
1–01	Steam, coal-burning	598	848	2,407	3,720
1–02	Steam, oil-burning	108	168	454	683
1–03	Diesel-electric[1]	3,396	3,113	13,432	12,627
1–06	Total	4,123	4,154	16,382	17,124
2	Passenger yard switching hours (000):				
2–01	Steam,coal-burning	21	29	88	132
2–02	Steam, oil-burning	7	11	25	47
2–03	Diesel-electric[1]	252	254	1,026	1,022
2–06	Total	312	328	1,267	1,336
3	Hours per yard locomotive-day:				
3–01	Steam	6.60	7.10	6.50	7.30
3–02	Diesel-electric	16.40	16.60	16.30	16.80
3–05	Serviceable	14.90	14.40	14.70	14.60
3–06	All locomotives (serviceable, unserviceable and stored)	13.10	12.50	12.90	12.60
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.72	1.80	1.73	1.79
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.74	0.76	0.75	0.77

[1]Excludes B and training A units.

Miscellaneous Publications

BATTERIES.—Advertising department, C & D Batteries, Inc., Conshohocken, Pa. Specification *Bulletin DL-576* covers C & D lines of diesel-locomotive starting batteries and gives details as to dimensions, wet and dry weights, types of containers, and capacities at the 2-, 6-, and 8-hr. rate. *Bulletin AC-546* covers line of C & D batteries for use in railroad car lighting and air-conditioning services. Gives dimensions, wet and dry weights, types of containers, and capacities at three- and eight-hour rates.

CYLINDRICAL GRINDERS.—Landis Tool Company, Waynesboro, Pa., 24-page Catalog K-53 describes and illustrates the Landis 12-in. by 28-in. Universal and tool grinder. Includes also specifications and equipment lists.

■

DUCTALLOY.—American Brake Shoe Company, Department A, 230 Park avenue, New York 17. 12-page booklet, 8½ in. by 11 in. Describes three standard grades of Ductalloy (ductile iron) for castings in chemical, diesel, and general industrial fields.

■

NAILABLE STEEL FLOORING—Great Lakes Steel Corporation, Steel Floor Division, Ecorse, Detroit 29. Six-page illustrated folder gives descriptive, engineering, installation and application data on use of Nailable Steel Flooring in gondolas, box cars and refrigerator cars. Completed installations, application details and hold-down methods, illustrated.

(Continued on page 123)

They Stopped... Looked
...And WE Listened

During the recent Atlantic City convention more than 800 railroad men visited the International Caboose — and it was interesting to hear their comments . . . to watch their reactions . . . to talk with them as they expressed their opinions and beliefs.

From these observations, we found it to be the consensus of railroad executives and mechanical men that:

- **Cabooses are the most neglected and outmoded equipment on the line.**
- **This condition contributes to the limited speed, capacity and efficiency of freight trains with consequent loss of revenue.**
- **International Cabooses offer design and construction features that will overcome these shortcomings.**

They RECOGNIZED the sturdy all-steel construction that could withstand heavy pusher service and terrific rack-in and rack-out. They NOTED and REALIZED the importance of International's many, improved safety features. They APPROVED the accomodations that enable the conductor and the crew to work at peak efficiency.

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NEW!

ALL STICHT HAND TACHOMETERS now equipped with IMPROVED SLIP COUPLING OVERSPEED PROTECTION DEVICE

...TO PREVENT DAMAGE BY ACCIDENTAL OVERSPEEDING ON A WRONG RANGE

Write for New Bulletin No. 751 Describing These New TYPE "UO" HAND

TACHOMETERS

Specially Recommended for Diesel Service Shops:

CAT. NO. 303 with 5 RANGES

30-120 RPM
100-400 RPM
300-1200 RPM
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3000-12,000 RPM

BY ROTATING RANGE SELECTOR

Also Available: New Type "SO" Single Range 200-1200 RPM

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REPAIR — instead of buying replacement parts

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on all types of heat transfer units

- Retubing all models of oil cooler cores
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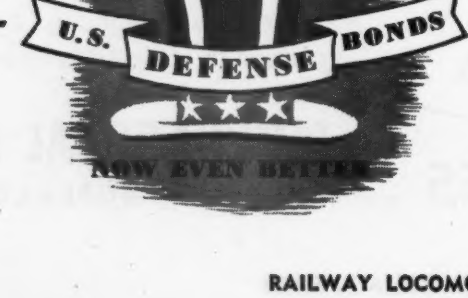


SUPPLY TRADE NOTES

BALDWIN-LIMA-HAMILTON CORPORATION.—*E. H. Schoonmaker*, acting manager of the St. Louis district sales office of the

E. H. Schoonmaker

Eddystone division of Baldwin-Lima-Hamilton, has been appointed district manager there.

■

COLORADO FUEL & IRON CORP.—*E. J. Byrnes, Jr.*, has been appointed assistant general manager of sales, Eastern division,

E. J. Byrnes, Jr.

at New York. Mr. Byrnes was previously product sales manager of the springs and formed wire department.

■

VAPOR HEATING CORPORATION.—*H. J. Schickedanz* has been transferred from Washington, D. C., to New York as assistant manager; *Alec Stikkers*, from Los Angeles to Chicago as assistant service manager; *Lester Bolin*, from Denver to Los Angeles; *E. E. Cowan*, from Chicago to Denver; and *James T. Chinlund*, from Chicago to Philadelphia.

■

LORD MANUFACTURING COMPANY.—Lord Manufacturing has moved its Detroit field engineering office to 2842 West Grand boulevard.

DEVILBISS COMPANY.—*DeVilbiss Manufacturing Company, Ltd.*, Canadian subsidiary, will shift manufacturing operations from Windsor, Ont., to a new $600,000 plant at Barrie, Ont., about December 1, according to the president of the DeVilbiss Company. The new plant will cover 63,800 sq. ft. and will provide for consolidation of manufacturing and general offices in one building.

■

AEROQUIP CORPORATION.—Aeroquip Corporation, Jackson, Mich., has enlarged its operating facilities through purchase of a one-year-old plant with 45,000 sq. ft. of space, at Van Wert, Ohio.

NATIONAL SUPPLY COMPANY.—*A. H. Candee*, who recently retired as transportation engineer of the Westinghouse Electric Corporation, has been appointed motive-power consultant for the National Supply Company, engine division, at Pittsburgh.

■

KOPPERS COMPANY, WOOD PRESERVING DIVISION.—*R. P. Jackson*, manager of the Chicago district, has been appointed executive assistant to vice-president, Western region. *C. F. Seyer, Jr.*, manager of the Texarkana district, has been transferred to the Chicago district and has been succeeded by *S. S. Curtis*. *G. M. Dewart* has

Three CDF TAPES to meet your heat and electrical insulating needs

C-D-F Silicone Tapes for A.I.E.E. Class H Electrical Insulation. Available in Varnished Fiberglas cloth and Silicone Rubber-coated Fiberglas cloth. Resistant to high temperatures; high dielectric strength, low dielectric losses, excellent moisture resistance and high tensile strength. They resist mild alkalis, non-oxidizing acids, mineral oils, oxygenated solvents. Available in a range of sizes on continuous rolls. Write for Technical Bulletin #47.

C-D-F Tapes of Teflon* have the desired mechanical and electrical properties for heavy duty motor, generator, and conductor insulation. Unaffected by temperature fluctuations, exposure to oils and greases, or weather conditions. Fiberglas supported and unsupported Teflon tapes are available in a range of sizes.

C-D-F Micabond Tapes have an inherently high and permanent resistance to heat with good dielectric properties. Micabond Tapes are used for insulating motor and generator armature and field coils, turbogenerator coils, and many similar applications where flexible high quality insulation of A.I.E.E. Classes B and H insulators are required. Available in a wide range of sizes with many different backings including: fiberglas, silk, Cellophane*, cotton, paper, and Mylar*.

If you have an insulating problem, probably a C-D-F product is the answer. C-D-F manufactures and fabricates electrical insulation, laminated and molded plastics. Sales offices are located in principal cities. Call your C-D-F sales engineer—he's a good man to know!

*du Pont trademarks.

THE NAME TO REMEMBER .. CDF SILICONE, TEFLON, MICABOND TAPES

Continental-Diamond Fibre Company

NEWARK 104, DELAWARE

2 NEW Strand GRINDERS

FLEXIBLE SHAFTS

NEW RAILROAD MOUNT—Specially designed for the Strandflex 4-speed Gear Drive Flexible Shaft Machine for grinding, sanding, rotary filing, wire brushing, drilling, etc. You can take the Railroad Mount right to the work, use either as a standard flexible shaft machine, or as a fixed machine by locking the handpiece in the specially designed handle clamp.

NEW GASOLINE POWERED UNIT
All-purpose compact 5 hp. gasoline engine powered Flexible Shaft Machine produces governor controlled operating speeds ranging from 2200 to 3200 rpm. without the need for electricity or air compressors. Especially useful for Bridge and Building or Maintenance of Way Departments for grinding rail welds, smoothing concrete, wire brushing before painting. Also adaptable to driving other machines.

Write for details on these two Strand Flexible Shaft Machines specially designed for railroad use.

FRANKLIN BALMAR CORPORATION
Woodberry, Baltimore 11, Md.
5001 North Wolcott Avenue, Chicago 40, Ill.

been appointed district sales manager of the Denver district.

Douglas Grymes, Jr., manager of railroad sales, has been appointed sales manager, with responsibility for both railroad and commercial sales. *J. M. Irvine*, manager of commercial sales, has been named project manager. *Robert H. Devine*, assistant manager of railroad sales, has been appointed assistant to manager of the consolidated sales department with continued responsibilities in railroad sales work.

Douglas Grymes, Jr.

Mr. Grymes was associated with the Ayer & Lord Tie Co., which later became part of Koppers' wood preserving division; after various sales assignments, he was assistant manager of railroad sales for three years until December 1952, when he became manager of railroad sales.

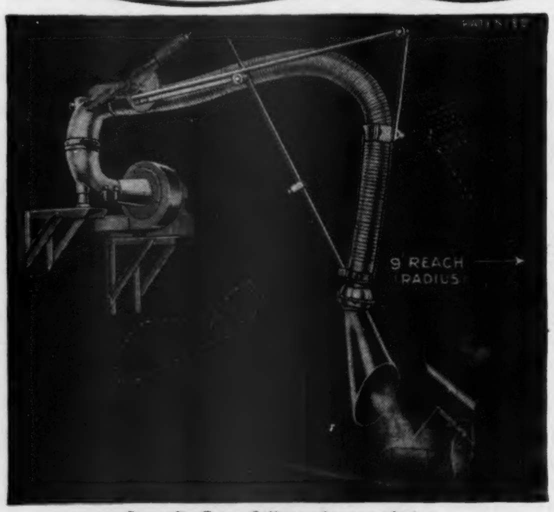
The Wood Preserving division plans to erect a new wood preserving plant at Horseheads, N. Y., as soon as local permits are granted.

■

Dixie Cup Company.—*Albert Smith* has been appointed national sales manager of water cups, transportation and governmental sales, for the Dixie Cup Company, at Easton, Pa. Mr. Smith was formerly assistant national sales manager of the government department and water cup division.

A. Smith

"It certainly is a relief to have fumes and heat removed while I'm welding. The Ruemelin Collector has great suction. It makes a day's work pleasanter!"



Ruemelin Fume Collector in operation.

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated at their source, thus improving working conditions, lessening fatigue and paving the way for increased plant production.

The Ruemelin Fume Collector hood can be instantly placed where needed anywhere in the booth welding area. No tedious adjustments necessary. Just pull the inlet hood to the welding position and you are ready to go.

Note the new spring-loaded counterbalance mechanism which makes Fume Collector much easier to handle. Ask for Bulletin 37-E illustrating this new feature.

RUEMELIN MFG. CO.
MANUFACTURERS AND ENGINEERS
SAND BLAST AND DUST COLLECTING EQUIPMENT
3982 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

A. M. BYERS COMPANY.—*J. J. Merrill*, field service engineer in the Chicago division for 11 years, has been appointed Boston division manager.

■

EVANS PRODUCTS COMPANY.—*James R. Byrne*, assistant operations manager of railroad loading and equipment division, has been appointed assistant sales manager of that division.

J. R. Byrne

Donald R. Ward, director of manufacturing schedules, has been appointed assistant to president.

■

VANADIUM CORPORATION OF AMERICA.—*Frederick F. Franklin* has been appointed manager of Transportation Development,

F. F. Franklin

with headquarters in Chicago. Mr. Franklin was previously chief of the Ferroalloys Section and assistant director of the Iron and Steel Division.

■

MCDOUGALL-BUTLER COMPANY.—*William A. Boyer* has been appointed a sales representative, with headquarters at 2929 Main street, Buffalo. Mr. Boyer will represent McDougall-Butler in portions of south-western and north-western New York State.

■

SHERWIN-WILLIAMS COMPANY.—*Frank J. Bonner* has been appointed zone manager, Pacific industrial sales, with headquarters at 3423 Piedmont avenue, Oakland, Calif. Mr. Bonner, who was previously area salesman in southern California, will also head west coast transportation sales.

You don't have to stock a lot of different cleaners for a wide variety of railroad cleaning operations. For every one of the jobs indicated above, you can get faster, better and lower cost cleaning with just ONE specialized railroad cleaner.

Stock JUST ONE MATERIAL for All These Jobs!

Magnus 5RR is very different from ordinary soaps and powders. It is both a detergent and a solvent, that works just as well in cold as in hot water. You use very little 5RR to make a cleaning solution (about a teaspoonful to a gallon of water). It rapidly penetrates oily, greasy dirt deposits, dissolves the oil and grease, and leaves surfaces bright, clean and *streakless*.

DEODORIZE AND DISINFECT AT THE SAME TIME

The ingredients in Magnus 5RR deodorize and disinfect as they clean. Yet they are harmless to all good paints and varnishes, and mighty easy on the hands. Magnus 5RR cuts down materially on cleaning labor time, because of its fast action and elimination of heavy manual scrubbing.

PUT IT ON THE JOB FOR A MONTH

Order a drum of Magnus 5RR. Use it for 30 days according to our recommendations. If, at the end of that time, you are not completely satisfied, send the unused material back and we will cancel the full invoice.

magnus CLEANERS

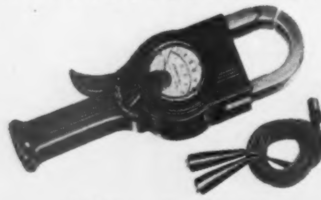
Railroad Division

MAGNUS CHEMICAL CO., INC.

77 South Avenue, Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Representatives in All Principal Cities



A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs... including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

Specialized and Multi-purpose

INSTRUMENTS

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- RESEARCH
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Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

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Instruments

Industrial Circuit Tester—Model 785

A multi-range, multi-purpose, ultrasensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.

Model 901
Portable Test Instruments

Available in d-c, Model 901 and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

A. O. Smith Corporation.—*The Valley Bearing & Equipment Co.,* Chicago, has been appointed sole sales agent for the new A. O. Smith Boxweld unit and hangar-type freight brake beams.

■

Libbey-Owens-Ford Company.—Libbey-Owens-Ford will sell its railroad fabricated glass materials direct to the railroad industry. It has discontinued its selling arrangements with Silvercote Products, Inc.

■

Buffalo Brake Beam Company.—*Ernest F. Gladwell,* western and Canadian sales representative, appointed assistant to the vice-president, sales, with headquarters at Buffalo.

■

Superheater Company.— *S. L. Brownlee,* who has been appointed manager of sales for the Superheater Company, Division of Combustion Engineering, Inc., as announced in the August issue, started his career as a special apprentice on the Rock Island, and from 1925 to 1938 was associated with the Worthington Corporation as field and service engineer. He then entered the employ of Superheater as service engineer in the western district and became sales manager of that district in October 1951.

S. L. Brownlee

■

Waukesha Motor Company.—*Lee W. Melcher,* for 20 years head of the refrigeration and railway division, has retired.

■

National Carbon Company.—*J. R. Johnstone* has been appointed manager, carbon products sales department. Mr. Johnstone has been associated with National Carbon since 1937 in various sales and administrative positions.

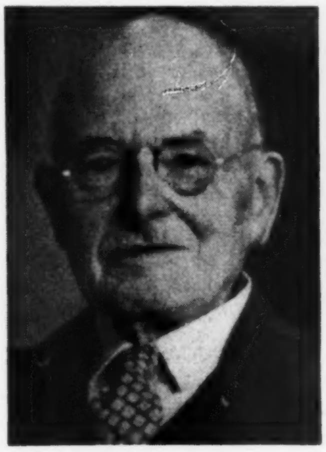
■

Wilkening Manufacturing Company.—Wilkening has appointed the *Seneca Tool Corporation,* New York, the agent for the sale of Pedrick piston rings to railroads in East Central and Northeastern states.

Obituaries

Robert C. Augur, 87, former managing editor of the *Locomotive Cyclopedia* and the *Car Builders' Cyclopedia,* published by Simmons-Boardman Publishing Corporation, died at his home in Suffern, N. Y., July 16. Mr. Augur, who was born in New

Haven, Conn., was a graduate of Sheffield Scientific School, Yale University, in 1887, with a Ph.B. degree. He was employed for several years on the Chicago, Burlington & Quincy. He later was assistant mechanical engineer and chief engineer of the New York Air Brake Company; resident engineer of the Westinghouse Air Brake Company, and engineer of tests for the American Brake Shoe Company. He was also employed as director of inspection, Westinghouse Electric Corporation, at Philadelphia, and as installation engineer, propelling machinery, Federal Shipbuilding Company. From 1920 to 1948 he was managing editor of the *Locomotive Cyclopedia* and *Car Builders' Cyclopedia*, and thereafter consulting editor until 1951, when he retired.



Robert C. Augur

FRED G. TEUFEL, regional sales manager of Gould-National Batteries, Inc., died at his home in Cleveland, July 6.

PERSONAL MENTION

Atlantic Coast Line

JOHN C. FOSTER, foreman electrical department at Jacksonville, Fla., appointed general diesel supervisor at Wilmington, N. C.

E. J. HALEY, general foreman at Florence, S. C., appointed master mechanic at Rocky Mount, N. C.

E. B. WHITE appointed general foreman, with headquarters at Florence, S. C.

Baltimore & Ohio

H. S. BERGMAN, assistant superintendent of shops at Baltimore, appointed superintendent of shops at Glenwood, Pa.

Bessemer & Lake Erie

J. S. STULTZ, traveling engineer, appointed road foreman of engines.

Canadian National

ROBERT BURN, assistant electrical engineer at Toronto, appointed electrical foreman at Stratford, Ont., motive-power shops.

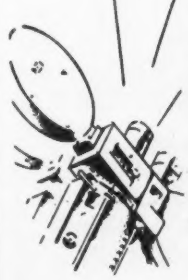
This is GARLOCK'S 3-Dimensional Picture

1. The Garlock representatives—112 of them—selling Garlock products and nothing else—making periodic calls on your plant—offering you the most complete line of mechanical packings manufactured by any company. These men are trained, experienced and, through interchange of information throughout the Garlock organization, conversant with your mechanical packing problems.

2. Twenty-three offices and three branch factories—with stocks of Garlock products—situated in most principal cities throughout the United States—convenient to you for prompt shipments and competent service.

3. Factories, laboratories, service engineers, resident engineers and pilot plant at Palmyra, New York—with background of sixty-six years' experience in the manufacture, application and development of superior quality mechanical packings—GARLOCK—The Standard Packing of the World.

This is the Garlock picture—unique in the mechanical packing industry. Take full advantage of it. It is yours for the asking.



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Sales Offices and Warehouses: Baltimore • Birmingham • Boston Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) Philadelphia • Pittsburgh • Portland (Ore.) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

Branch Factories: Birmingham • Denver • San Francisco.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS, RUBBER EXPANSION JOINTS

Chesapeake & Ohio

C. A. JORDAN, engineer—car fabrication at Russell, Ky., appointed office engineer, mechanical department, at Richmond, Va.

R. M. BORMAN, general foreman at Cheviot, Ohio, appointed general foreman at Peru, Ind.

Chicago, Milwaukee, St. Paul & Pacific

H. A. GROTHE, shop superintendent at Milwaukee, appointed district general car foreman at Minneapolis.

GEORGE L. WOOD, JR., appointed general car foreman at Minneapolis.

JAKE HANSEN, district general car foreman at Minneapolis, appointed shop superintendent at Milwaukee.

Minneapolis & St. Louis

J. O. CONVERSE, mechanical engineer at Minneapolis, has had duties extended to include supervision of the car department.

New York Central
MICHIGAN CENTRAL DISTRICT
Equipment Department

H. R. WINGEART appointed general car foreman, with headquarters at Jackson, Mich.

D. H. CALLAGAN appointed lubrication inspector with headquarters at Detroit.

Pennsylvania

JOHN L. PARKER, assistant manager, Altoona Works, appointed general superintendent of methods and cost control in the office of assistant vice-president—operation and chief of motive power, at Philadelphia.

G. R. WEAVER, superintendent of motive power, Central Region, appointed assistant works manager at Altoona, Pa.

W. J. FULTON, superintendent of motive power—diesel, Western Region, appointed superintendent motive power, Central Region.

R. C. JOHNSTON, master mechanic, Chicago division, appointed master mechanic, Philadelphia division, with headquarters at Harrisburg, Pa.

Union Pacific

WILLIAM J. WILSON, engineer of diesel and electric locomotive design at Omaha, has retired.
Career: During World War I associated with the Baldwin Locomotive Works and the Whitcomb Locomotive Works. Had also been chief engineer of the McKeen Motor Car Company at Omaha. On the UP helped design and develop early streamline trains and diesel locomotives.

Wabash

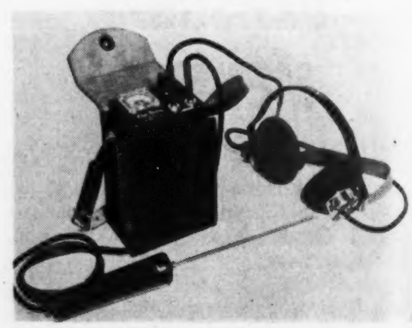
W. A. POWNALL, assistant to general superintendent of motive power at Decatur, Ill., has retired.

For a host of railway applications, the fast, economical Hypressure JENNY does a thorough cleaning job in one-tenth the time that hand methods require. It is particularly useful for cleaning locomotive and car running gear parts and subassemblies before machining, thus saving 25 to 60% in shop production time.
JENNY, the original and only fully patented steam cleaner, is manufactured by Homestead Valve Mfg. Co. More than 40,000 units are in daily use throughout industry. Portable, self-contained, it rolls to the job; and from a cold start, is ready for use in less than 90 seconds. Models and capacities for every railroad need. *Write for complete information.*

Exclusive Distributors to the Railroads
RAILROAD SUPPLY *and* EQUIPMENT *Inc.*
148 ADAMS AVE., SCRANTON 3, PA.

New Devices

(*Continued from page 114*)



equipment. The unit, known as Model V, includes a milliammeter for checking sound impulses visually, in addition to the standard headphones for audible operation. The combination, it is stated, enables the operator to "see as well as hear" the location of the source of trouble in bearings, pistons, gears, ratchets, cams, clutches and other moving parts.

The accurate performance of the new video unit, it is claimed, is assured by the use of a highly stable germanium crystal diode in the circuit. This crystal serves to rectify the current to record the electrical impulses accurately on the d.c. milliammeter, and to provide the wide frequency response required.

Silicone Varnish

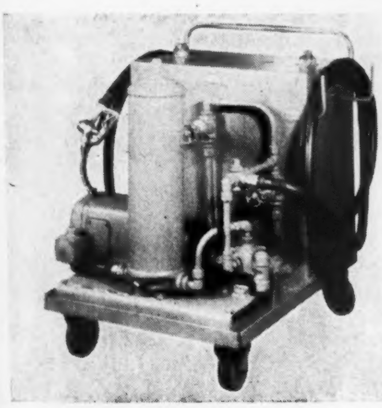
Dow Corning silicone varnish 997 is a new Class H dipping and impregnating varnish which the manufacturer states has over 100 times the dielectric life of typical Class B varnishes at 200 deg. C. and shows less tendency to bubble on curing. Total processing times are therefore comparable to those required for Class B machines and only ¼ to ⅐ as long as those previously required for Class H equipment.

Tests indicate a dielectric life expectancy at 250 deg. C. of only 60 hours for the Class B varnish compared with 2,000 hours for Dow Corning Silicone Varnish 996, and 4,,500 hours for the new No. 997 varnish.

The varnish shows even less tendency to bubble at 300 deg. F. than some of the better organic varnishes. Graduated curing temperatures are no longer necessary because Class H equipment impregnated with Varnish 997 can be placed directly into an oven at 400 deg. F. without bubbling.

Even though somewhate higher baking temperatures are still required, total processing times for equipment impregnated with Varnish 997 are now about the same as those used in the production of comparable Class B equipment.

■



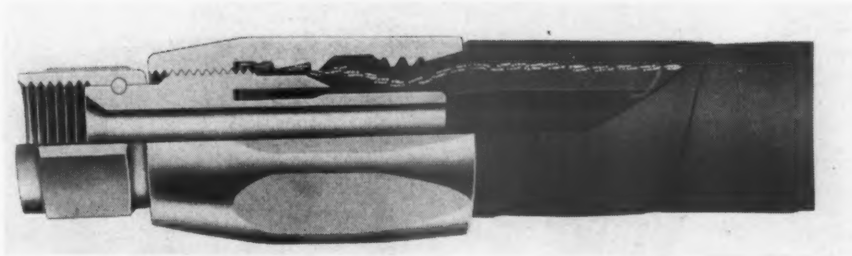
Portable Hydraulic Filter Unit

Recently announced by J. N. Fauver Company, Inc., Detroit 1, is its new portable hydraulic filter unit. This device was designed for pumping hydraulic oil from a machine, through a filter and back into the machine or into tanks for transport or storage.

The apparatus consists of a portable tank with a 55 gal. and a 20 gal. section, hose assemblies, filter, pump, fittings and tubing, nozzle, valves and 3-way cock. It is powered by a ½ hp. motor.

■

Steam Hose Line



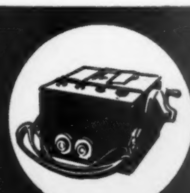
Greater efficiency and maximum safety are claimed for a burst-proof steam hose line introduced by Aeroquip Corporation, Jackson, Mich. This device is constructed of a natural rubber inner tube with either one or two plies of steel wire braid depending on hose size. An asbestos braid is applied over the wire reinforcement. The outer cover consists of an oil resistant butyl rubber cover.

A feature of the hose line is its "Little Gem" fitting which is attached to the hose in the same manner as other Aeroquip detachable, reusable fittings. This fitting assures, according to the manufacturer, posi-

MIDGET MEGGER® CIRCUIT TESTING OHMMETER

measures down to .1 ohm. Has two ranges, with selections from 0 to 3 ohms up to 100 to 200,000 ohms. Battery supply.

Bulletin 21-85-X



BRIDGE-MEG RESISTANCE TESTER

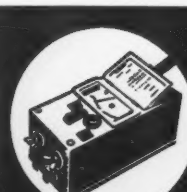
measures down to .01 ohm. A resistance tester combined with a Wheatstone Bridge. Hand generator operated. Available 5 ranges: 0 to 20 megohms up to 0 to 1000 megohms.

Bulletin 21-60-X

MEGGER® LOW RESISTANCE OHMMETER

measures down to .000010 & .000100 ohms. Two ranges, 0 to 1000 and 0 to 10,000 microhms. Either battery or rectifier-operated. Entirely contained.

Bulletin 24-46-X



DUCTER® LOW RESISTANCE OHMMETER

measures down to .000001 ohm. Battery or rectifier-operated. 4 or 5 ranges each instrument: 0 to 100 microhms up to 0 to 5 ohms.

Bulletin 24-25-X

***These* MEGGER® INSTRUMENTS *give you Reliable* Low Resistance Measurements**

All these instruments are portable, rugged field instruments that give long, trouble-free service. They are simple to use and, of course, embody the utmost reliability that is always associated with the Megger trade name. For checking circuit continuity, measuring the resistance of switch contacts in microhms —for laboratory, production line, or out-in-field trouble-shooting—every electrical man should have one or more of these Megger instruments available.

Check and Mail Coupon for Bulletins listed above.

JAMES G. BIDDLE CO.

• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT

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Please mail me ☐ Bulletin 21-85-X
☐ Bulletin 21-60-X ☐ Bulletin 24-46-X ☐ Bulletin 24-25-X

*Name*________

*Job*________

*Company*________

*Address*________

...a mighty expensive animal to feed!

Yessir, folks! It's lots cheaper to change diesel-electric brushes than to re-grind and recondition commutators!

And so Stackpole diesel traction brush engineering aims first of all at good filming qualities and *minimum* commutator wear even under adverse operating conditions. Performance records of Stackpole brushes on leading railroads prove beyond question their ability to keep commutators in service for long periods of time. In exceptionally difficult applications, Stackpole brushes *actually improved poor commutator conditions* that had developed when other makes of brushes were used!

And brush life was entirely adequate in the bargain!

STACKPOLE CARBON COMPANY
St. Marys, Pa.

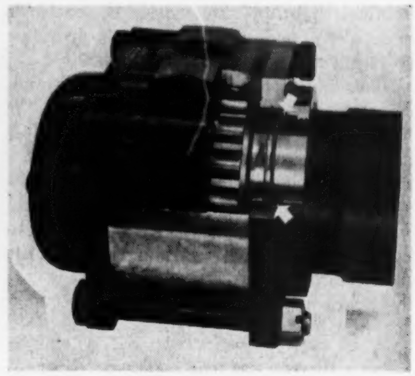
STACKPOLE *diesel-electric* **BRUSHES**

BRUSHES FOR ALL ROTATING ELECTRICAL EQUIPMENT • BEARING MATERIALS BRAZING FURNACE BOATS • CARBON PILES • CLUTCH RINGS • CONTINUOUS CASTING DIES • DASH POT PLUNGERS • FRICTION SEGMENTS RAIL BONDING MOLDS • RESISTANCE WELDING AND BRAZING TIPS • SEAL RINGS • TROLLEY AND PANTOGRAPH SHOES... and dozens of carbon-graphite specialties

tive attachment to the hose, without the need for periodic adjustments.

These hoses are currently being produced in ½, ¾ and 1 in. sizes. Other sizes are being developed.

■

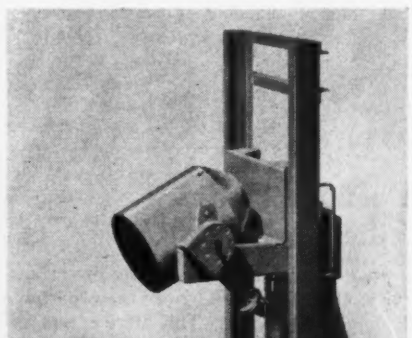


Double-Lip Oil Seal

An oil seal designed for protection of journal box roller bearings has been announced by the Garlock Packing Company, Palmyra, N. Y. Designated as the Klosure Oil Seal, It has a double-lip seal. One lip keeps the lubricant in next to the bearing; the other sealing lip keeps foreign matter away from the bearing.

This seal has a synthetic rubber sealing element. A garter spring around the sealing element maintains a light, but uniform, pressure on the shaft.

■



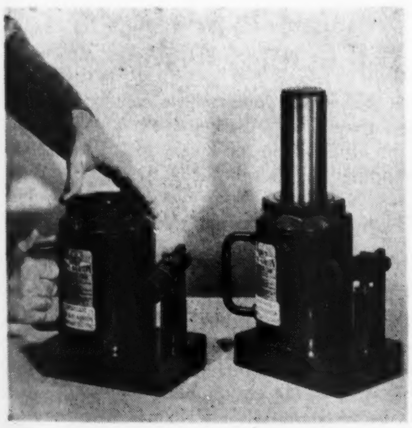
Cobalt 60 Radiography

Technical Operations Incorporated, 6 Schouler court, Arlington, Mass., announces the design and production of the DES, a portable directional exposure shield for the safe handling of strong sources of Cobalt 60 for industrial radiography. The DES can be used for thick or thin sec-

tions, from six in. or more down to only a fraction of an inch of steel, brass, bronze, etc. This equipment functions to shield all radiation from a gamma source except a beam, which may be directed only at the area to be exposed. During the exposure, the radiographer is perfectly safe in the immediate area as long as he is outside the actual beam.

The Cobalt 60 is moved into or out of position by merely rotating a handle through 180 deg. When the source is retracted, the shield serves as a storage container. No specially constructed shielded room is required for exposures. The DES is ruggedly constructed of heavy-gage steel filled with lead. It is mounted on an easily portable castered lift truck, with either hand or electric power lifting. All models are 3½ ft. long, 2½ ft. wide and 6 ft. or more high depending upon the model. Exposure calculations are simple. The source may be raised to 56 in. or lowered to 12 in. from the floor. The beam may be varied from straight up to 45 deg. below the horizontal. No power supply is required, except for a lift truck on electric hydraulic model.

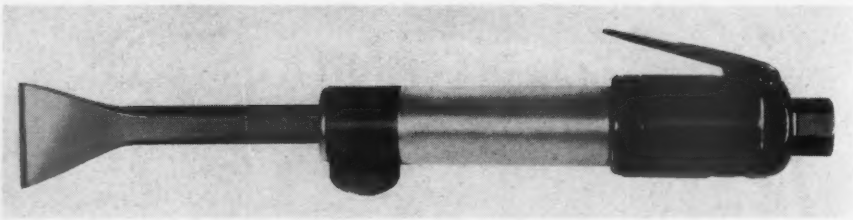
■



A 35-Ton Journal Jack

A 35-ton hydraulic journal jack has been developed by the Duff-Norton Manufacturing Co., Pittsburgh, Pa. This jack was designed principally for servicing journal boxes on the heavier type freight cars.

Among the features claimed for this new hydraulic jack—which is a big brother of the 25-ton capacity models introduced by Duff-Norton in 1948—are the following: Patented automatic air vent eliminates 90 per cent of "air lock" difficulty, formerly encountered with some early model hydraulic jacks; 25 per cent lighter for the same capacity because patented vent design permits using smaller reservoir, thus making possible smaller, lighter base; air vent screw and bothersome adjustments are eliminated; with no air vent set screw to opeon or close during jack operation, the usual fluid leaking point is eliminated; single pump with longer stroke gives more rapid lift with less pumping motion; fewer moving parts mean less wear, longer, trouble-free service.



Flux Scaling Hammers

Three new models of air-operated weld flux scaling hammers, featuring a small, light-weight design, have been announced by the Thor Power Tool Company, Aurora, Ill. All are $7\frac{3}{4}$ in. long and weigh $2\frac{1}{8}$ lb. They may be used for corner welds or one-hand operation where space is a factor. Exhaust air, blown from four holes in the front of the barrel toward the work, removes loose chips and scale to maintain surface visibility.

Other applications of the new air hammers include paint scraping, rust removal, wood chiseling, small casting sand removal, and mold cleaning. The three models are identical except for the type of throttle—lever, push or button. All have a $\frac{3}{4}$-in. bore, a $\frac{9}{16}$-in. stroke and couple to $\frac{1}{4}$-in. hose. For manipulation around irregular shapes and contours without twisting or kinking the hose, a swivel hose connection is available as optional equipment. Straight chisels, angle chisels or mortar chisels may be used.

■

NAFCO*

... foremost among DIESEL FILTER CARTRIDGES

RAILWAYS NATIONWIDE PLACE THEIR CONFIDENCE IN NAFCO*

Construction Features make the difference!

1. Tough, fine mesh cotton outer covering guards against cartridge damage.

2. Cotton thread waste, machine-packed to even density, equalizes filtering.

3. Heavy fine mesh tubing covering center tube acts as additional filtering agent.

4. Strong, reinforced steel center tube with free flow perforations for maximum efficiency.

5. Two-way gasket seals out oil by seating and squeezing action. Oil can't by-pass.

EXTRA PROTECTION AT NO EXTRA COST

Nafco Oil Filter Cartridges are used in diesel engines on the nation's leading railroads. Every cartridge is of uniform size and design, easy to install and remove. Guaranteed to meet all R. R. specifications, Nafco Cartridges are made of quality materials for longer, more dependable service performance. Specify Nafco and be sure of the best.

**Registered Trade-Mark of Nash Finch Co.*

FREE. Send for bulletin giving complete facts and cartridge reference chart.

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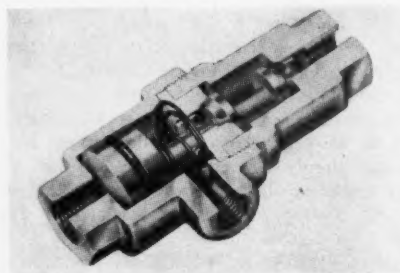


Pressure Type Automatic Ejectors

A series of automatic ejector valves to regulate the discharge of water, oil, carbon and sludge from air tanks of industrial air equipment, diesel locomotives, air compressors, etc., have been developed by the George Manufacturing Company, Philadelphia 44.

Made in $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in. female drain inlet sizes, they operate on pressure taken from the governor or unloader line. The manufacturer claims that the devices do not effect or interfere with any part of manufacturing equipment.

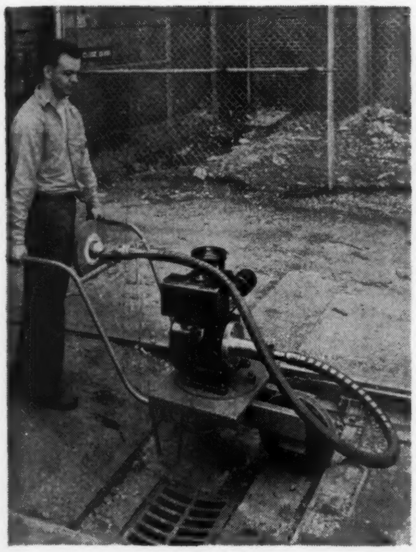
For installation all that is necessary is to connect the ejector to either the bottom drain hole or the syphon drain hole with I.P.S. fittings. Insert a tee in the unloader line between the governor, magnetic pilot valve, pressure switch, etc., and the pump. Then run a $\frac{1}{4}$ in. outside diameter copper tube between the ejector and the tee and face the discharge downward. If it is desired to pipe the discharge away, use $\frac{3}{8}$ in. I.P.S. fittings or $\frac{3}{8}$ in. outside diameter tubing to prevent a back pressure.

These ejectors have been designed and made available in monel, aluminum or bronze construction. They weigh 1 lb. and require no supports.

■

Engine Driven Flexible Shaft Unit

This unit is recommended for use in the field where electric power is not available such as railroad tracks and construction work. To make a portable grinder independent of electric power supply, the gasoline powered flexible shaft unit, desig-



nated the Model BGX-7, was developed by the Franklin Balmar Corporation, Baltimore 11, Md.

Power is supplied by a one cylinder engine equipped with an adjustable governor to give the motor a speed range from 2,200 to 3,200 r.p.m. The engine develops 3.55 hp. at low speed and 5.1 hp. at the high speed and is started with a starter rope.

A wheel barrow type truck supports the engine which is mounted on a swivel plate which permits a swing of 180 deg. A swing lock arrangement locks this swivel plate in various positions.

It is equipped with a 7 ft. flexible shaft which is attached directly to the motor shaft. The shaft consists of a ¾ in. flexible core and a vulcanized casing. An arbor style hand spindle is attached to the tool end of the flexible shaft. The arbor has a ¾ in. by 10 thread and carries a 10 in. dia. grinding wheel.

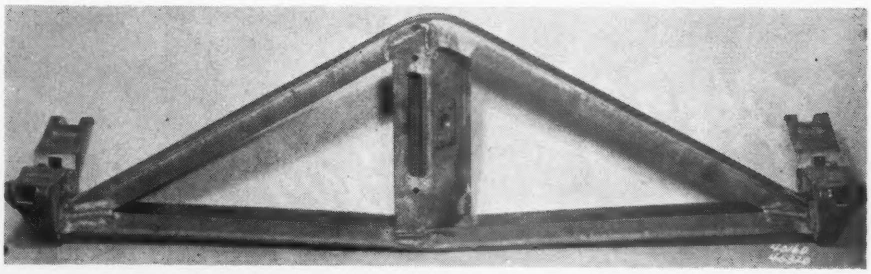
■

Hanger Type Brake Beams

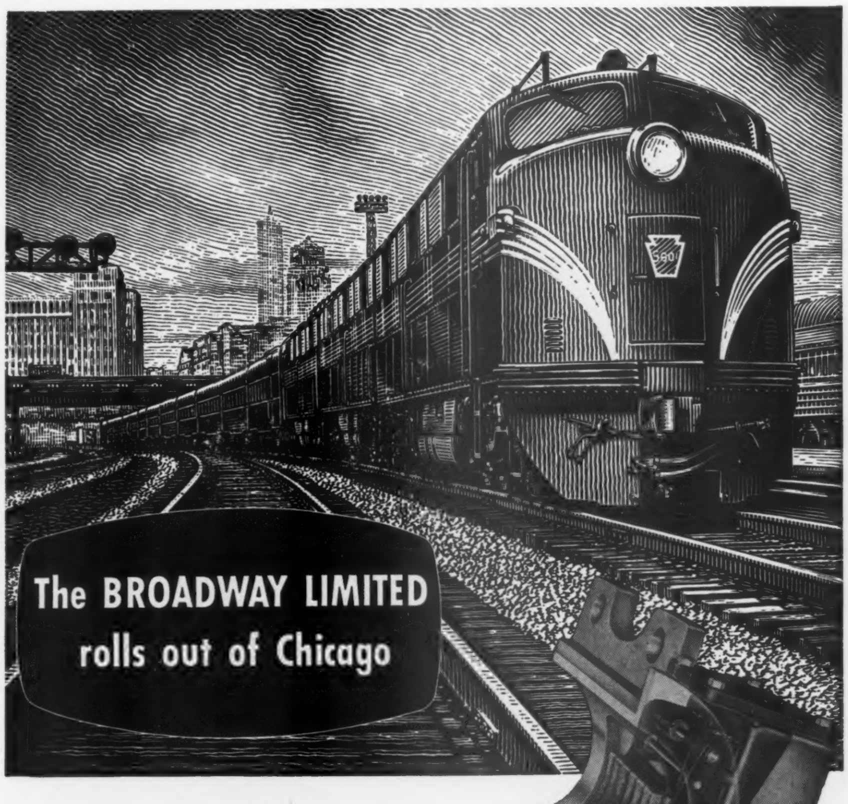
Boxweld Unit and hanger-type freight brake beams of 18,000- and 24,000-lb. capacity have been designed and manufactured by the A. O. Smith Corporation, Milwaukee, Wis., and are sold by the Valley Bearing & Equipment Co. They comprise balanced designs of brake beams with weight reductions up to 40 per cent, accompanied by greater strength and load-carrying capacity. A dead weight saving of approximately 160 lb. per car is effected.

Boxweld all-steel brake beams are completely welded into one piece. The faces of brake heads and other wearing surfaces are made from wear resistant steel, then hardened.

This beam was named Boxweld because the compression and tension members are both channel section which are welded at the ends to form a box section. The fulcrum is also a box section integrally welded into the compression and tension members. The fabricated steel brake heads are separtely welded and are subsequently welded to the ends of the box section of the beam.



A.A.R. Certificate No. 68 has has been issued for a 24,000-lb. capacity Unit brake beam and Certificate No. 71 for a 24,000-lb. hanger-type brake beam. Both brake beams are now ready for service applications.



Pennsylvania Railroad's Diesels depend on . . . FELPAX Lubricated Bearings

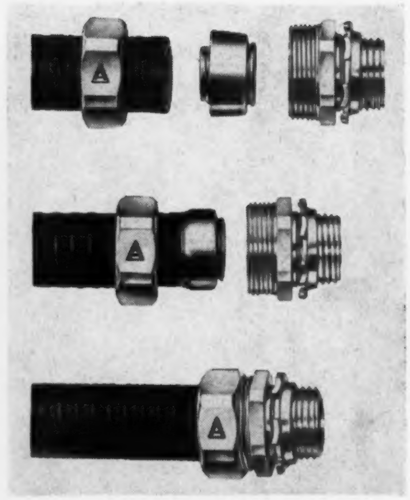
The suspension bearings on Pennsylvania Railroad's Diesels receive instant lubrication with the first revolution of the axle, continuous lubrication at all speeds. Waste grabs and starved bearings caused by old fashioned yarn packing are eliminated. Special wicks, exclusive with Felpax Lubricators, last thousands of miles . . . help maintain fast schedules.

the lubricator that eliminates repacking

Solve your suspension bearing lubrication problems with Felpax Lubricators. See your locomotive builder or write:

MILLER FELPAX LUBRICATOR

MILLER FELPAX CORPORATION
WINONA, MINNESOTA



Liquid-Tight Connectors

Liquid-tight electrical conduit connectors have been placed in production by Appleton Electric Company, 1701-59 Wellington avenue, Chicago. They are U.L. approved for protection of electrical conductors on machinery, and they are recommended where a liquid-tight flexible raceway is required.

The design of these connectors provides for an all-metal flaring ferrule which, under the compressing action of the tightening nut, is joined securely with the conduit into a liquid-tight connection.

Designated as the ST series, these connectors assure a positive means of excluding oil, water, acid fumes, chemicals, grease and dirt from the wiring system, and provide a positive ground between flexible conduit and connectors. The electrical resistance between the connectors and the conduit is extremely low.

The connectors are furnished complete with all accessories. They are available in straight, 45-deg. and 90-deg. connectors and for conduit sizes from ⅜ in. to 1¼ in.

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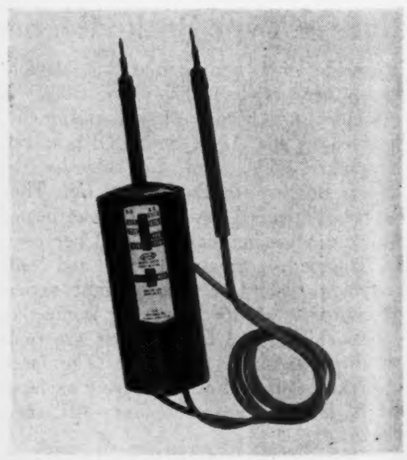
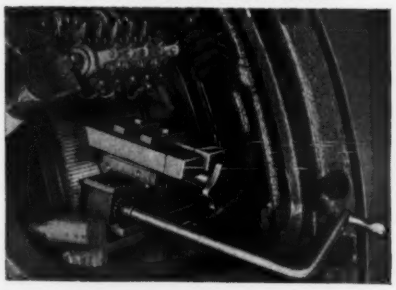


Voltage Tester

Ideal Industries, Inc., 1560 Park avenue, Sycamore, Ill., has announced an all-new voltage tester. The tester will show nominal line voltages from 110 to 550 a.c., and 110 to 600 d.c., as well as distinguish between a.c. and d.c., and show polarity of d.c. lines. The unit is designed for use

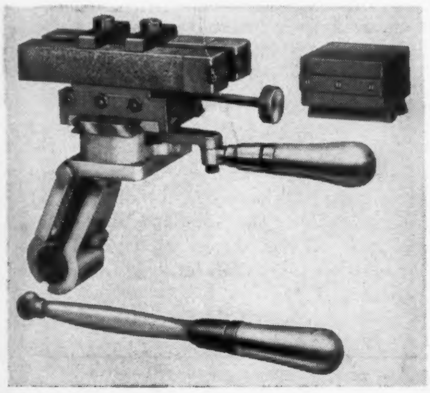
MARTINDALE

DIESEL-ELECTRIC COMMUTATOR MAINTENANCE EQUIPMENT
COMMUTATOR GRINDER



New design makes resurfacing of Diesel-electric commutators more accurate, easier, faster. Carriage is chain-driven, travels on ball-bearings. Adapters for mounting grinder on virtually all models of Diesel generators and motors are also furnished.

TYPE C COMMSTONE HOLDER



Holds Commstones rigid and true for concentric resurfacing of smaller Diesel-electric commutators such as auxiliary generators and amplidyne exciters. Mounts on brush arm by means of an adjustable support.

MICA-MILLER UNDERCUTTER

A powerful, light-weight, low cost, easy to use Undercutter, operating from 1/5 h.p. Universal motor. Available with small, medium or heavy-duty head (interchangeable). Also available with air motor or flexible shaft drive.

Send for new 64-page Catalog No. 29 of Maintenance, Production and Safety Equipment.

MARTINDALE ELECTRIC CO.

1337 Hird Ave. Cleveland 7, Ohio

by electricians, maintenance men and electrical contractors.

Testing of voltages up to 600 volts requires a high margin of safety in instruments of this kind. The Ideal tester has been designed with this feature foremost and has many unique safety factors. Prod handles are integrally molded to neoprene insulated leads and include tip insulation and safety rings. The one-piece, sturdy plastic case is completely enclosed to keep out dust, moisture and foreign matter. There is no exposed metal on the exterior of the case, which could carry current from the working parts.

Interior construction features a solenoid coil, layer-wound on a one-piece nylon spool. The coil is firmly secured at both ends to prevent movement within the case. Coil leads have been isolated to avoid crossovers and possibility of shorts. A neon lamp in parallel with the solenoid provides a double check on circuits.

Convenience use-features include prod storage wells, which conceal sharp tips and a socket in which either prod can be mounted for easy handling.

■

Maintenance of Bendix Spray Tips

It is important to maintain the original finish on spray tips and noses in order to minimize the wastage of fuel and loss of power. The proper method of cleaning tips, especially when coated with carbon deposits, is detailed below and was prepared by the Scintilla Magneto Division, Bendix Aviation Corporation, Sidney, N. Y.

A cleaning solution is prepared by dis-

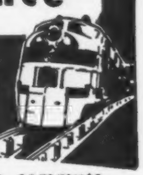
Spray holes not properly cleaned result in waste of fuel and power loss.

Holes cleaned by immersion method result in fuel economy and maximum power.

IDEAL

SHORTCUTS to better commutator maintenance

QUALITY-BUILT TO DO THE JOB RIGHT! . . .

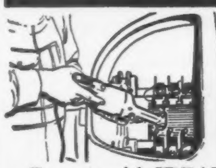


The easiest way to restore commutators in traction motors and generators without dismantling during interim maintenance...or during periodic overhauls. IDEAL Resurfacers and other tools are used by leading railroads and recommended by locomotive builders.

RESURFACERS

Refinish commutators to like new condition even when ridged, scored or burned. Wood block handles clamp rigidly into grinder. Seven sizes, in all grades from extra coarse to extra polish.

MICA UNDERCUTTERS



Work easily in close quarters. Several models. Direct drive or by flexible shaft. For use with IDEAL Commutator Saws and Milling Cutters.

FLEXIBLE ABRASIVE

Cleans and burnishes commutators. Non-dusting. Complete size range.

CLEANER-BLOWERS

Blows air at high velocity and harmless low pressure. Lightweight and rugged. May also be used as a vacuum cleaner or sprayer. Three models: ⅖, ⅔ and 1⅓ H.P.

FREE 39-page Handbook Complete information on commutator maintenance. Mail coupon.

IDEAL Products Are Sold through Leading Distributors

IDEAL INDUSTRIES, Inc.
1563 Park Avenue, Sycamore, Illinois

Send FREE Handbook and catalog sheets on:

☐ Resurfacers ☐ Flexible Abrasive
☐ Undercutters ☐ Cleaner-Blowers

Name________
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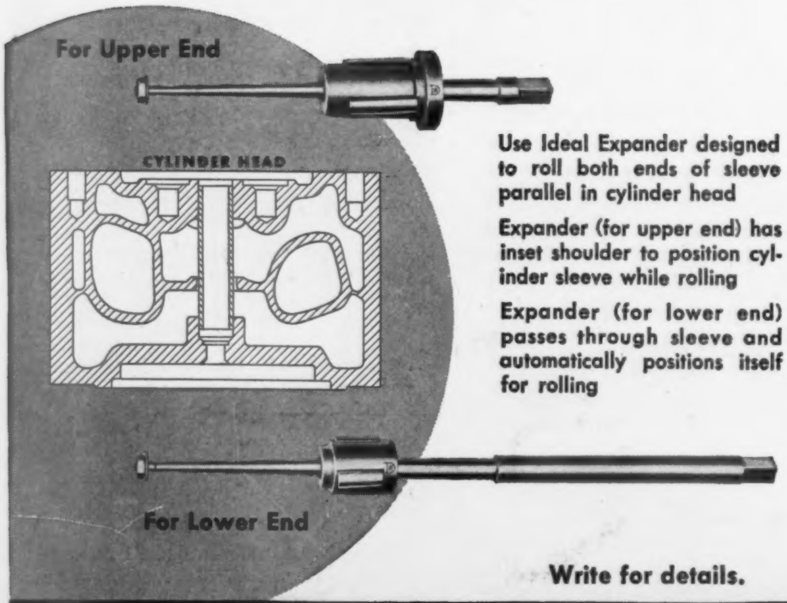
For Rolling in DIESEL Cylinder Head SLEEVES



Use Ideal Expander designed to roll both ends of sleeve parallel in cylinder head

Expander (for upper end) has inset shoulder to position cylinder sleeve while rolling

Expander (for lower end) passes through sleeve and automatically positions itself for rolling

Write for details.

THE GUSTAV **WIEDEKE** COMPANY
DAYTON 1, OHIO

solving in water, some Lakeseal TU-2 cleaning compound in the proportion of one oz. of compound to each gal. of water. This formulation is available from the Finger Lakes Chemical Company, Etna, N. Y.

Submerge the tips in this solution and heat to boiling for 10 min. Then remove the tips and dry and use compressed air to blow out each sprap tip from the orifice end. Polish the end with a piece of crocus cloth dampened with oil.

Do not use emery cloth or any form of wire brush to clean the tips as this will cause bell mouthing of the holes and roughen the surface.

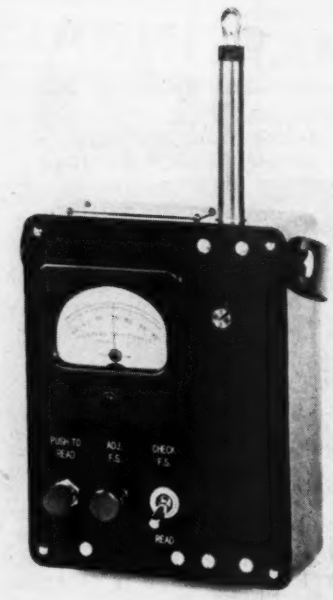
■

Temperature Indicator

Response to temperature changes in two seconds or less is obtained with Model 328 Fastherm temperature indicator manufactured by Associated Research, Incorporated, 3758 West Belmont avenue, Chicago 18.

Originally designed for checking heating and air conditioning efficiency in railroad passenger cars, Fastherm is a self-contained battery-powered electrical bridge type indicating thermometer. High response speed has led to other applications where temperatures other than ambient must be indicated quickly.

The sensing element is a thermistor,



mounted in a protective cage at the end of a retractable prod. When in operating position, the prod extends approximately 4 in. above the top of the instrument case. Retracted, the prod and thermistor are entirely within the case.

Temperature readings are made on a 2-in. meter with an accracy of 3 per cent of full scale. The standard model range is from 60 deg. F. to 90 deg. F. Other ranges are available from 20 deg. F. to 220 deg. F.

Two standard flashlight cells power the

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Engineering experience is apparent in the smooth mechanical operation of the Johnston Car Bottom Furnace. Roller bearings in car and door hoist shafts, and power operated car pullers are just a few of many practical features. Johnston "Reverse Blast" low pressure burners for oil or gas assure clean, economical, efficient heat for annealing, normalizing, and stress relieving.

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